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Original Contributions.

CONSTITUTIONAL CAUSES OF TOOTH DECAY.'

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It is my purpose here to direct attention out of the usual channels of discussion of tooth decay and to approach the subject by a different line of thought. Three decades ago, while pursuing research work among the neurotics and degenerates in this country and Europe I was struck with the rapid decay of their teeth. This made such an impression that I have since collected data from time to time upon the subject. Owing to the necessity of completing certain lines of research then laid out, this important subject could not be taken up in detail until within the past five years. This delay has been an advantage. Microscopic technique has so advanced as to now enable me to accomplish what would have been impossible earlier. Papers recently read by Kirk, Kester and Stubblefield have prepared the minds of the profession for the conception that there are other factors than lactic acid ferments. I am therefore relieved of the necessity of first demonstrating that constitutional factors influence tooth decay. In the study of disease two factors must always be considered—first, the tissues or soil; second, the bacterium or other cause. Most of the research work on tooth decay has dealt with bacteria or local causes, usually ignoring constitutional influences, soil or culture medium.

While, as Dr. Black states, there is no difference between soft and hard teeth so-called as regards the crushing force, still a vast difference in tooth structure from a physiologic and pathologic viewpoint exists as to vitality and decay. Teeth differ widely as

¹Two former papers, "Evolution of the Pulp," read before the Section on Stomatology of the American Medical Association, 1902, and "Vaso-motor System of the Pulp," read before the same society, 1903, lead up to this paper.

to the quality of filling required. A tooth in its senile or pulpdegenerating stage resembles in tissue change a tooth in the constructive stage, so far as resistance is concerned. Having outlined the scheme of reasoning, some data collected in the past three decades deserve attention.

In any public institution for degenerate children the teeth will be found badly decayed. Teeth of degenerate children living at home decay faster than those of healthy children of the same family. Teeth of pregnant women decay faster than before pregnancy. At the senile period or the period of involution under mental strain teeth decay rapidly.

A forty-six-year-old woman had two sons and a daughter. The daughter at eighteen was attacked by peritonitis and died within a week. From persistent grief of the mother the teeth, previously in good condition, presented in eight months many cavities.

A forty-two-year-old woman was well-to-do financially. Her husband had charge of her property. She went abroad for two years and he was to bring her home at the end of that period. He failed to do so and kept her abroad for two years more. Remittances becoming short, she returned to find that her husband had squandered all her property, so she obtained a divorce. Resultant worry, as dermatologists would believe, turned her hair white. There was likewise marked recession of the alveolar process and gums from interstitial gingivitis as well as rapid decay of the teeth.

The teeth of a thirty-five-year-old woman became soft and decayed rapidly from deep grief over the sudden death of her husband.

Grief from its trophic results causes abrasion and erosion. The most marked cases are those occurring from death of husband, wife or children or loss of wealth. Drilling into pulp cavities of these types is often done without pain or hemorrhage; pulps are removed without pain and with little hemorrhage; marked changes take place in enamel and dentin; the tissues not infrequently become softened; the incisors break off near the gum under pressure. All of these states occur in neurasthenia and melancholia.

A forty-eight-year-old newspaper owner and editor became postmaster of a large city. Resultant mental strain produced neurasthenia, with interstitial gingivitis and rapid decay of the teeth. Here the teeth were normally hard as flint, the enamel cut with difficulty, the dentin was as hard as the enamel. When the extra nerve strain was applied the enamel became brittle and the dentin cut like horn or old cheese.

Tooth decay occurs much more rapidly when neurasthenia is present, irrespective of the cause.

The teeth of paretic dements and tabetics decay rapidly. People who possess neurotic tendencies and inherited taint from consanguineous marriages or excesses suffer from tooth decay and irregularities. Severe illness will cause tooth decay and change the color to a dirty yellow, regardless of age, softening tooth structure. In hemiatrophy tooth decay and interstitial gingivitis occur on the affected side and perhaps to a lesser extent on the other. In heart lesions (fatty degeneration, valvular disease, etc.) decay is rapid. Syphilitic and tubercular patients have tooth decay and interstitial gingivitis, while tooth erosion, abrasion and discoloration also occur in relation to nerve disorder and disease.

The cutting or wearing away of the anterior teeth by the tooth brush below the enamel on the lower jaw and above the enamel on the upper is no doubt due to a softening of the dentin from systemic and internal causes. Such teeth are easily cut with bur, excavator or drill. Their pulps are less sensitive and bleed less than normal in removal.

A boy with sound healthy enamel after recovery from pelvic abscess complained of his teeth feeling gritty. Dr. P. J. Kester found that the enamel had disintegrated.

In typhoid fever the enamel becomes brittle and cleaves from about fillings and decayed edges. On the grinding surface of the teeth of those of middle-age, especially neurotics, the enamel wears away and the dentin is hollowed out as in erosion. Teeth which are soft with chalky enamel at one period may on the other hand become hard with organized enamel at a later period and stop decaying.

Dr. G. D. Boak states as to Philippine climatic effects upon the teeth: "While the weather is by no means as hot as it is at times during the summer in the States, the average temperature for the islands is about 89° F. It is a continuous heat without invigorating change of seasons. This gradually saps vitality and enervates, producing the lassitude which is characteristic of the tropics. Enervation produces anemia, with corresponding lessening of the resisting powers from the lower vitality, especially in those who have lived

previously in temperate climates. Caries is frequent and progresses rapidly in this climate." This Dr. Boak attributes to the following causes: First, lowering of the vitality by a lessening of the resisting powers; second, acidity of the oral secretions.

As DeMoor has shown, tooth decay under the law of economy of growth is a necessary phase of evolution. The jowllike face is going, and with it teeth pass from the megadont type to the microdont or some must disappear. A pathologic tendency to extend tooth decay beyond this often occurs. The spontaneous death of the pulp should be considered in this connection. Tooth decay is more common now than years ago. Teeth of Mound-builders, Cliff-dwellers and primitive races indicate this. Notwithstanding all the work that is done for the teeth, decay is greatly on the increase. It is more common in those who are advanced in civilization and brain development.

The work and results of Miller as regards the immediate cause of tooth decay may be accepted, as also the proposition that the teeth in public institutions as a rule are not kept as cleanly as in homes.

Study of the causation of tooth decay necessarily begins with embryogeny, histology and physiology of the structures. In "Evolution of the Pulp" I showed that the pulp was all-important for vital tooth existence, that the epithelial layer was a necessary factor, and that the alveolar process was a necessity after the tooth erupted. In evolution of the pulp from the placoid scale of sharks through its various stages to man there has necessarily been marked degeneration of it as a single structure for the benefit of the whole body, not unlike the vermiform appendix, ear muscles, short ribs, little toe, pineal body, etc., but to a more marked extent. Man's evolution in head bend and brain through the law of economy of growth has of necessity caused the jaws, alveolar processes, pulps and teeth to degenerate for the benefit of the organism as a whole.

The law of Aristotle (the struggle for existence between organs or the law of economy of growth), clarified and amplified by Goethe, 1807, St. Hilaire, 1818, must operate while life exists. The jaws, alveolar processes, teeth and their pulps are no longer supremely important structures for the existence of man. As such they tend to disappear under the law of economy of growth.

The teeth of man vary widely from their original type and function. Higher development from the lower vertebrates changes an

animal's surroundings and habits; therefore his structure and form must under the law of economy of growth be adapted to the new environment. In this evolution the head, face, jaws and teeth have undergone the greatest change. The fossil birds and reptiles had seventy-two teeth; some of the edentates have forty-two, while man reaches his highest physical development when he possesses thirtytwo teeth. Man has not yet adjusted himself to his new environment. The jaws are still growing smaller and teeth are still disappearing—the third molar and lateral incisor for instance. certain systemic conditions other teeth are lost and not infrequently no teeth develop. Not only are the jaws growing smaller but the alveolar processes are growing longer and thinner, which in turn reduces the vitality and support of the teeth. Interstitial gingivitis results and absorption of the alveolar processes takes place. In the natural closing of the foramina of the teeth nourishment to a great extent is cut off and decay easily attacks them or they drop out. By other methods also does the law of economy of growth rid man of useless organs. Decay is, however, a much faster method and in line with present environment. It may therefore be a normal process along the line of the law of economy of growth whereby a structure or organ is lost for the benefit of the organism as a whole. It is often a national tendency rather than a local one.

Embryogeny of these structures is governed by the same laws as other structures. As I have shown in "The Stigmata of Degeneracy" (The Medical Examiner and Practitioner, March, 1902), the brain early develops at the expense of other organs. Between birth and the third month the brain is one-fifth the weight of the body; in the adult it is one thirty-third; during the first six months it doubles in weight. Since the brain presides over development of the tissues of the body through its trophic and vaso-motor systems it must be as fully developed and normal in construction as possible so that body tissues may develop normally. Pleasure, happiness and laughter aid digestion, while melancholia and grief may retard growth and function and produce tropho-neuroses. An unstable nervous system produces unstable tissues, i. e., either excessive or arrested.

While the nervous system has other special functions, the one great object is that of regulating growth and repair. As Marinesco has shown, this function resides even in the neuron or nerve unit.

Growth and repair are regulated through the trophic and vaso-motor systems. In the domain of bone growth, trophic nerve anomalies were first observed. Brown-Sequard demonstrated anomalies in tabetic joints of sufferers from locomotor ataxia and later similar states were observed in the jaws. Another allied neurosis, paretic dementia, presents similar trophic disturbances, as Kiernan pointed out twenty-five years ago. (Journal of Nervous and Mental Diseases, 1878.)

Among these tropho-neuroses is one characterized by loosening and falling out of the teeth by alveolar resorption, gingival ulceration and perforation, with at times maxillary necrosis. This condition has long been recognized by alienists and neurologists as causing that loss of the teeth which occurs in paretic dementia, locomotor ataxia and diabetes. This function of the trophic nerves, as I have elsewhere shown, has received but little attention from dentists, albeit its influence has been recognized in dental pathology in connection with the great neuroses in which gum disorder occurs, followed by the loosening of the teeth.

Degeneration of the peripheral nerves due to interruption of the connection with the central nervous system was first shown by Nasse and Valentine in 1839. Not until 1850, however, was a thorough study made of nerve degeneration by Waller, the pathology of which is now known by his name. Wallerian degeneration implies change in the terminal ends of the peripheral nerves after they have been cut, which consists in coagulation or breaking up of the myelin sheath, destruction of the axis cylinder, the neurilemma with its nuclei remaining for some time preserved. (The Nervous System. Barker.) If a sensory nerve be cut through peripheral to the spinal ganglion complete degeneration ensues.

Similar experiments showed that if the dorsal root of a spinal nerve be cut through at a point between the ganglion and the spinal cord the portion of the nerve attached to the ganglion did not undergo the typical degeneration, while the portion still connected with the cord showed the characteristic degeneration phenomena which could be traced throughout the whole course of its constituent fibers in the dorsal funiculi of the cord. The cells of the spinal ganglia have therefore been looked upon as trophic centers for the peripheral sensory nerves and their intramedullary continuations.

Similar degenerations in the domain of the central nervous sys-

tem likewise occur; secondary descending degeneration of the pyramidal tract, established by Turck, and ascending secondary degeneration in the spinal cord after transverse lesion being analogous.

Converting then, as Barker remarks (Ibid.), the Wallerian doctrine into terms of the neuron concept, the following general law may be laid down—"Whenever it has suffered a solution of continuity, with severing of its connection with the cell body and dentrites of the neuron to which it belongs, the axon, together with the myelin sheath covering it, undergoes in the part distal to the lesion acute and complete degeneration. This degeneration includes not only the main axon but also its terminals, together with the collaterals and their terminals connected with it."

Some investigations have shown that the slightest injuries to nerve cells or neura will give rise to easily demonstrable degenerative lesions in other parts of the cell. The most significant instance is in lateral sclerosis, where the pyramidal motor cells of the cortex show no marked lesions, though the most distal portions of the nerve fibers arising from them have gradually degenerated.

In some peripheral nerve diseases, according to Strumpell, the degeneration of the distal portion of the axones may be due to direct action of toxins exerting a deleterious influence upon the cell body or the whole neuron. In Wollenberg's opinion the primary type of disease of the sensory neura in tabes is of this kind.

As Sydney Kuh (American Medicine, Vol. 111, No. 21, Pages 865, 868) has shown, in some of the toxic forms, as for instance in neuritis due to poisoning with lead and arsenic, the cells of the spinal cord as well as those of the spinal ganglia and brain may be diseased, and according to the neuron theory the toxic substances attack these cells before the nerve fiber itself is altered. Such an assumption explains why pronounced degeneration of peripheral nerves may occur without causing any appreciable symptoms. Pitres and Vaillard first showed that after typhoid fever many nerve fibers are found degenerated in cases where during life symptoms of neu-The same observers found like states in the ritis were absent. perves of those who had died from tuberculosis. Later observations have extended these states to such diseases as diphtheria, syphilis, alcoholism, carcinoma, inanition, marasmus, arterio-sclerosis and leprosy; in the so-called rheumatic neuritis of the facial nerve and to

inflammation due to articular rheumatism, gout, puerperal infection, tuberculosis, etc.

The method of cell poisoning has been observed in other intoxications. (The Nervous System. Barker.) Certain groups of neura are more susceptible than others to a given toxication. The same group of nerve cells in two individuals may react very differently to similar doses of the same poison. Syphilitic toxin shows a decided preference for certain parts of the cerebral cortex, other areas being less affected; the nerve endings in all parts of the body are markedly involved, especially those in and about the teeth. Peripheral nerve degeneration results where the blood current or the nerves themselves are involved from faulty metabolism, etc.

Nerve lesions more readily result where nerves are confined within restricted walls of transitory structures where the pulp has degenerated, especially in cases of hypercementosis of the root. When degeneration of the peripheral nerves in the pulp takes place there may at first be pain, continuously perceptible to the patient or absent except under manipulation or replaced by analgesia. In most cases there is analgesia, owing to the peculiar anatomic construction of the tooth and nerve degeneration. There is a loss of function. When degeneration sets in there is no pain either in the dentin or the pulp itself. This is peculiarly noticeable in drilling through dentin into the pulps of syphilitics, tubercular persons, tabetics, paretic dements, and those suffering from drug poisoning. This peculiar lack of pain sensibility may occur when the enamel is defective and the dentin has turned a dirty yellow. Teeth with defective or no enamel, and cutting like horn, may be manipulated without pain. Not infrequently the pulps can be removed alive and without pain in persons who have had protracted illness. The nervous system loses its resistance and disease easily runs its course. This is why so few degenerates survive. It is also a reason why their teeth decay so early and readily. Defectively-formed enamel, interglobular spaces, and a want of resistance are fruitful soils for germ diseases or decay.

The checking effect of a disordered nervous system upon the jaws, alveolar process and teeth in their embryogeny is not unlike that exerted upon other structures. Marked illustrations are cases where teeth develop without crowns or enamel, or the structure be like horn, or where the epithelial layer becomes arrested and pits and grooves are seen in the enamel. The effect upon the structure of the

enamel and dentin has been shown by Andrews, Black, Williams, Tomes, Hopewell-Smith, Allen, Sudduth, Latham and many others. Not only are there interglobular spaces but faulty structure results. Indeed, so common is this the case that hardly a tooth is exempt. Scarcely anything different could be expected when it is remembered that the teeth are degenerating structures and that there is rarely a normal pulp.

Arrest of development in the upper jaw is more common than in the lower, owing on the one hand to the upper's fixed attachment to the other bones of the skull under the law of economy of growth, and on the other hand to the mobility of the lower. Hitchcock, Magitot and others have found decay of the teeth more frequent on the upper than on the lower jaw. The checking influence of the nervous system which produces arrest of development of a jaw bone must affect the embryonic structure of the teeth, hence more frequent decay upon the upper than the lower. Decay of the teeth is more common in arrested jaws where the teeth are irregular than in well-formed jaws and teeth. The lower jaw being movable, more blood is sent to the part and the bone is less liable to become arrested. The same explains why there is less decay of the teeth upon the lower jaw, as the vitality of the structure is greater. Arsenic applied to the periphery of the dentin will reach and destroy the pulp.

When the pulp is destroyed there is no more sensitiveness on the periphery at the neck of the tooth, or where the enamel has been removed, showing that nerve sensation extended through the dentin when the pulp was alive. Teeth are sensitive to excavation, but not when the pulp is destroyed. When the pulps have been destroyed the cement substance which holds the enamel rods together loses its tenacity and the rods cleave readily apart, the dentin cuts much easier and decay is more rapid. Quite an odor from the decomposed animal matter in the tubules of the dentin is observed when cut either with an excavator or bur. If a tooth that has been removed on account of interstitial gingivitis be cracked open the odor is loath-some although the pulp is alive. The substance in the dentin must therefore give vitality to the tooth.

In the struggle for existence, owing to the changes which are taking place in the jaws and teeth at the expense of the brain, the trophic nerves are not directing nutrition to these parts, the result of which is degeneracy in structure. The pulp reaches its highest physical development and is at its normal size when it commences to form dentin. This is the highest normal period in lower vertebrates with open foramina. It degenerates from this period and never after recovers its normal physical condition. There are, according to Sudduth, Miller and others, no lymphatics in the pulp, it being a formative as well as a degenerative organ. The dental pulp is an end or terminal organ. No tissue in the human body is so completely without anastomosis. It is made

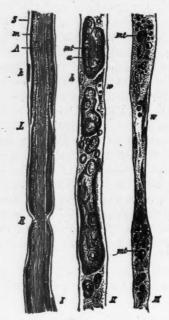


Fig. 1.

up of loops of blood vessels and nerves, virtually terminal structures, with a minute outlet which renders it a degenerate type of organ, like the alveolar process and all end structures, easily diseased. On the assumption that the dental pulp is the basis upon which the tooth develops and in a great measure obtains its nourishment and vital resistance, special investigations have been made by Dr. Vida A. Latham and myself with a view of studying its development, function and physical condition, which are not yet completed.

Starting with the proposition that evolution of the pulp from the placoid scale to its present state in adult life is a physiologic degeneracy, it is not difficult to trace pathologic degeneracy, since I have already demonstrated its vaso-motor system. Degeneration of the nerve endings must now be shown. For the purpose of studying this subject teeth have been collected, cracked open, and the pulps placed in different fluids for cutting, staining and mounting. Many methods and stains have been used. Stains that have proven successful on nerve tissue in other parts of the body do not work well



FIG. 2.

X 143.

or uniformly on pulp tissue, for owing to its unstable and degenerate nature the structure is rarely twice alike. Much care and attention are required to obtain good results.

It was thought best to incorporate the methods used in a separate paper for handy reference, hence I shall from time to time refer to the formula, and those interested can verify the results if so desired.

Figure 1 is a picture (partly schematic) showing Wallerian degeneration of nerve fibers after section. Thoma. 1, normal nerve

fiber; 11 and 111, fibers showing different degrees of degeneration; S, neurilemma; m, medullary sheath; A, axon; k, nucleus of neurilemma cell; L, marking of Lantermann; R, node of Ranvier; mt, drops of myelin; a, remains of axon; w, proliferating cells of neurilemma.

Figure 2 shows one of the main nerves of the pulp, extending to the center of the picture, when it branches into two distinct trunks. An artery faintly outlined may be seen behind the nerve trunk which also bifurcates like the nerve. The vaso-motor track is well marked



Fig 3. x 162.

by the circular coat of the vessels being cut in such a way as to show the outer walls running parallel with the nerve trunk. The single vessels show the corpuscles plainly. The trunk nerve consists of a number of medullated nerve fibers. Internodes can be plainly seen in some of them. In some of the nerve fibers varicosity or Wallerian degeneration is plainly seen. Internodes or Ranvier's nodes are also plainly seen. The basal structures in these pictures are seen only partially or not at all, since they are stained specially to bring out the nerve fibers.

Figure 3. The nerve trunks show the medullated character very well, many nodes of Ranvier being in evidence. Varicosities and various degrees of degeneration can be followed in the individual fibers. In a few fibers the darker axis cylinders with a higher stained primitive sheath are also seen. The various coats of the artery show the nuclei cut in transverse or vertical directions.

Figure 4. The nerve fibers in this picture present a much more swollen and thickened appearance than in Figures 2 and 3. The nuclei of the fibers show clearly and also varying degrees of thick-



Fig 4.

ening. Some fibers show drops of myelin or Wallerian degeneration. The upper bundle of fibers has become thickened and sclerosed. The basal structure with connective tissue fibers and cells is better shown than in the other pictures.

x 156.

Figure 5. In this picture appears a large nerve trunk much increased in size and ending almost abruptly like a neuroma in an amputation. The basal structure is very much altered, being of a chronic interstitial variety. There are few if any connective tissue cells but well marked bands of fibrous tissue. The individual fibers

of nerves show interruptions by the intermixing of the fibrous stroma, thus interrupting their function. The fibers are varicosed and vary in thickness.

In a previous paper I demonstrated the vaso-motor system and nerve endings in the arteries of the pulp. This, nerve-end degeneration, and the blood are the three sources by which any and all diseases and poisons of the body may affect the pulp and thus lessen the resistance of tooth structure.

Owing to the peculiar shape and location of the pulp, the small

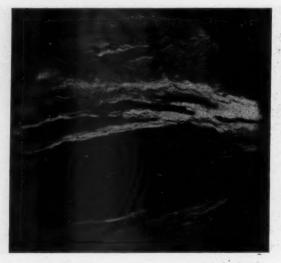


Fig. 5.

x 143.

capillaries and thin walls, external irritations increase the blood pressure in the small capillaries and veins enough to cause rupture without the aid of vascular changes, especially in cases of marked obstruction.

If the overflow of the venous blood in a given vascular area be totally interrupted, diapedesis of the red blood corpuscles from the involved capillaries and veins starts up, which is a result of the local increase in intravascular pressure.

The exodus of blood corpuscles through vascular degeneration occurs particularly after mechanic, chemic and thermal lesions of the vessel walls, certain poisons also affect the vessel walls with especial virulence. Claude Bernard's experiments show that dilations of the vessels follow paralysis of the local ganglia in their walls, while a disease like diabetes produces vaso-motor neuroses upon end organs.

Vaso-motor constriction of the pulp causes pure arterial hyperemia. Arterial dilation and redness are produced by constitutional disease or constriction at the apical foramina. As a result of this dilation



Fig. 6. x 59.

the blood current meets with less resistance in the pulp chamber, and a greater amount of blood flows into it. The pressure of the corresponding capillary rises, as the blood remains under greater pressure on account of the diminished peripheral arterial resistance. In this manner capillary and venous pulsation so frequently noticed in the teeth is brought about. There is no part of the body in which local hyperemia is so apt to occur as in the pulp, since constriction is always present.

Active hyperemia produces swelling of the pulp tissue, and on

account of its restricted space within the walls of the tooth the pulp cannot expand, and as there are no lymphatics debris cannot be carried off. The serum of the blood transudes into the tissue, and there being no collateral circulation death of the pulp must follow.

Local anemia or ischemia may result from lack of blood supply in the pulp either from constriction, disease, thrombosis of the arteries or the nerves at the apical end of the root, due to disturbance of the vaso-motor system.

Narrowing of the arteries increases the resistance of the current

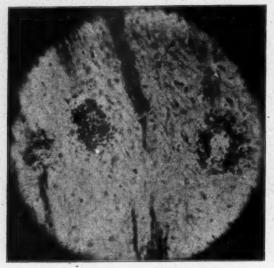


Fig. 7. x 156.

and the blood reaches the capillaries in the pulp under a very low pressure. This causes them to contract, and the area of the surface is materially diminished. End or terminal arteries like those in the pulp supply a definite organ or portion of the body and have little or no anastomosis with other branches. These are found in the spleen, the kidney, and certain parts of the brain and retina.

When local anemia resulting from constriction of a terminal artery occurs, as at the end of the root of a tooth, or as a result of

dilation due to the vaso-motor system, death of structure or organ takes place by coagulation, stagnation, neurosis or thrombosis.

When circulatory disturbances arise stasis takes place. When, according to Hektoen, the capillary loses all its plasma, as in local anemia, inflammation results from constriction due to the vasomotor system, thereby closing the apical end of the root of the tooth. Vaso-motor disturbance producing or accelerating inflammation has often been shown, therefore I shall not enter into a lengthy discussion of it. It is enough to say that any disease or action of the vasomotor system upon terminal structures (like the pulp) without lymphatics, constricted at the apical end and enclosed in bony walls, is very apt to produce or hasten inflammation.

The evolution, embryogeny, physiology and pathology of the pulp make it very susceptible to inflammation. Inflammation may result from external causes, the action of the vaso-motor system, nerve-end degeneration, or blood disorders. The external causes will not be discussed in this paper. Inflammation may occur at any locality in the pulp. I have previously observed an area of inflammation located at the horn at the center of the pulp and also in the apical end. The inflammatory process may pass through all the stages to pus infection and abscess without pain to the patient. This may be due to nerve atrophy, degeneration, or sclerosis, foramina constriction, or ganglion degeneration. It may be due to changes brought about in the vaso-motor system of the pulp. Tomes, Salter, Wedl and Harris all find that pulp inflammation may occur without exposure.

Black (American System of Dentistry) takes the student through the different processes of inflammation, where there is exposure of the organ. The same process results in inflammation of the pulp, except that the cause is internal instead of external. Whether resolution takes place or not will depend largely upon the vaso-motor system, and the size of the apical foramina to allow for circulation.

Figure 6. In this section of the pulp from a molar there are in the crown some large cells (myeloid) and pulp stones, which, by much irritation, have caused inflammation on one side even to abscess formation, vessel dilation and excess of red-cell infiltration. The other side is comparatively healthy, but has the round-celled infiltration showing in its very earliest condition. One, the smallest, just beneath the odontoblast layer, with well marked nerve fiber just beyond. A second, still further towards the center of the pulp

on the other side of it, shows a large nerve trunk, even the internode being visible in the low power, and just above it an area of nerve degeneration. Still lower down a darkening area is to be seen, showing a ruptured vessel, a large number of round cells with a small vessel or capillary shaped as a Y branching across a continuation of the lower nerve trunk. Degeneration in various stages is well marked.

Figure 7 shows a similar condition to Figure 6. This area was just beneath a coronal abscess with necrosis. Cells were pushing



Fig. 8. x 67.

into the connective tissue stroma and involving the arteries in some places. Just below one of the vessels cut nearly to the endothelial coat is a circumscribed abscess, one of a series of multiplying abscesses which occur all through the specimen. The special nerve staining renders it a difficult matter to bring out all the cellular detail, but same can be well understood under the microscope.

Figure 8 is a cross section of pulp with very early localized roundcell infiltration just beneath the odontoblasts. The pulp shows a slight increase in connective-tissue cells all through it. Numerous nerve trunks are scattered here and there both in cross and oblique sections.

Figure 9 shows a further stage of Figure 8 with some cloudy swelling, coagulation and a slight central necrosis situated beneath and to one side of the odontoblasts. Fibrous or interstitial pulpitis is well seen further under the abscess, with considerable fatty degeneration at one end. Figure 10 is a very advanced sequela of inflammation occurring near the coronal portion of the pulp. Above

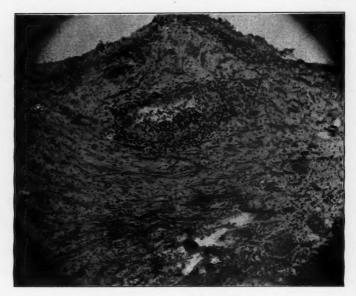


Fig. 9. x 67.

the part photographed the tissue has fallen out from necrosis. There is a well marked necrotic area with considerable round-cell infiltration. Some cells take the hematoxylin stain very well, many of them, polynuclear leucocytes and others, hardly take it at all. Some attempts at fibroid tissue formation can also be seen, forming a trabeculæ for the cells in places. There are also a few very small pulp stones.

Figure 11 is even further advanced than Fig. 10. The whole of one horn is entirely inflamed and rapidly terminating in suppuration

and necrosis. Many cells are in a state of parenchymatosis degeneration. Between strands of fibrous tissue, thickened and sclerosed nerve trunks, there are a very few small pulp stones around one end. On the further horn the odontoblasts are faintly outlined. In one spot there is a very small localized abscess, well marked round-cell infiltration, beneath the pulp is nearly normal, only a slight increase in odontoblasts. Passing down towards C another abscess and a liquefying area appears, and to the outer odontoblastic zone a scler-

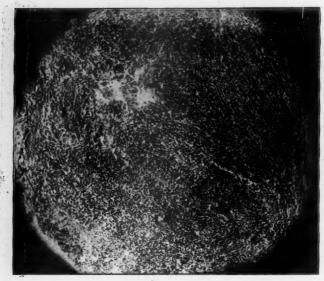


Fig 10. x 131.

osed nerve (e) in a hyalin fibroid tissue; the odontoblasts are no longer to be seen, their nutriment basement layer has fallen away at the lower part, a few again appear towards the cervical pulp as normal odontoblasts, but under same and deeper in the tissue is some fatty degeneration with a fibroid root portion of the pulp.

Figure 12. The interest of this photomicrograph lies in the fact that the abscess is situated midway of the curved part between the bifurcation of the roots. The whole pulp is filled with a greatly increased cell infiltration, especially in Weil's layer beneath the odon-

toblasts, the latter being granular in appearance. All the blood vessels are swollen and filled with a hyalin coagulation. A granular amorphous debris is seen everywhere through the basic substance of the pulp.

Figure 13 illustrates the extreme apical end of the pulp. One horn of the crown end is entirely destroyed by an abscess; the other horn is healthy. The nerve fibers are well stained. Passing down is a narrow area, slowly changing to a condition of atrophy. Below this the tissue seems to be in a healthy condition. As we pass down



Fig. 11.

X 20

toward the apex several small areas of round-cell infiltration may be seen, forming abscesses similar to Figure 6. The extreme apical end is shown in the picture, poorly-stained areas (cloudy swelling). some small fatty areas, trunks of degenerating nerve fibers. A suppurative area among the fiber and blood vessels with necrosis at the tip of the pulp apex. An artery cut across with thickened walls may also be seen at the left of the picture.

Neurasthenia is a common neurosis by which Preston remarks males are equally affected with females. It is a nerve instability in which in addition to ordinary nerve fatigue there is a morbid susceptibility to emotions and inability to restrain their manifestations. It is apt to make its onset near puberty when permanent teeth are most liable to decay. Temporary teeth are frequently badly decayed as a result of child neuropathy and hysteria. Permanent teeth later in life decay from premature senile neuropathy. Neurotic inheritance aided by the influence of climate and race tendencies, and an unstable, badly organized or imperfectly developed nervous system, are potent factors in tooth decay. When to this are added diatheses like tuberculosis, syphilis, etc., causes for tooth decay are

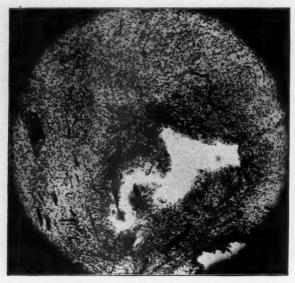


FIG. 12. X 55.

enormously increased. Any long-continued disease, grief, fear of litigation or death, also cause nerve fatigue, an excessive nerve waste and its retention. Anxiety, especially of young children, and between the ages of twelve and twenty-four, relative to their standing in school, is a fruitful source of nerve tire, nerve waste, and faulty metabolism. The forcing system of schools adds neurasthenia to the lists of accomplishments. While "all work and no play makes Jack a dull boy" from nerve tire and self-poisoning, the same is even more true of Jack's sister. Few universities do not have in their faculties

fairly typic neurasthenics from pedagogic worry and too one-sided life.

The causes just enumerated are in adults fruitful sources of nerve exhaustion. Elsewhere I have frequently shown that any excess is a fecund cause of nerve exhaustion. Neurasthenia occurs in every walk of life. People raised in luxury and idleness are the most evident victims of neurasthenia. Neurasthenia was particularly frequent among the second generation of Puritans, whence the

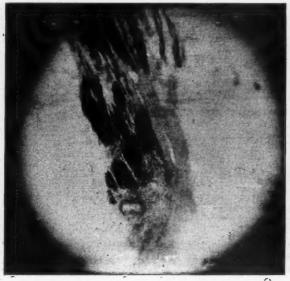


Fig. 13. x 50.

Salem witchcraft epidemic and the miraculous cures related by John Eliot. The lowest classes who give free rein to the appetites and the tramps are often neurasthenics, as are those between these two, persons who lead a sedentary life to which is added severe mental strain, care, responsibility, monotony, anxiety. Neurasthenia is frequent among clerks, teachers, literary workers, etc. It is often the ancestral phase of degeneracy; through it occurs the rapid decay of the teeth in persons over thirty or forty years of age who have had very little decay previously.

The effects of disease upon the pulp of the tooth, both through exposure, nerve-end degeneration, and the vaso-motor disorder, have already been described. These morbid processes produce spontaneous death of the pulp or diseased areas, thus lowering the vitality in the tooth as a whole, or in circumscribed localities. Want of tooth resistance allows lactic acid ferment to make rapid inroads upon tooth structure which would not otherwise occur had the vitality remained normal. Where disease appears the excretions are

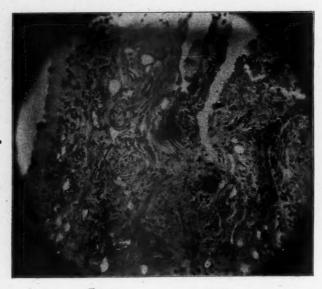


Fig. 14.

x 143.

vitiated and thereby greatly assist in promoting local decay. Acid secretions of the gums in unkept mouths of neurasthenics and degenerates, mixed with lactic-acid ferment, act rapidly in producing tooth decay at the cervical margins. Want of tooth resistance due to vaso-motor disorder of the pulp or nerve-end degeneration, as a whole or in areas, aids wearing away of the teeth in erosion and abrasion.

The effect of systemic conditions upon the pulp through the vaso-motor disorder, nerve-end degeneration and neurasthenia is to

produce other degenerations such as cloudy swelling, fatty degeneration, mucoid, colloid, hyalin, amboid, degeneracy, endarteritis obliterans, pulp stones, secondary dentin, neoplasm and fibroma. These degenerations will be elsewhere considered under "Degenerations of -the Pulp."

The question now naturally arises, "Does the pulp repair itself when injured or diseased?" Many have said that no lymphatics are to be found. Some state that no spaces are present. The natural impression is therefore that repair is impossible. In certain animals

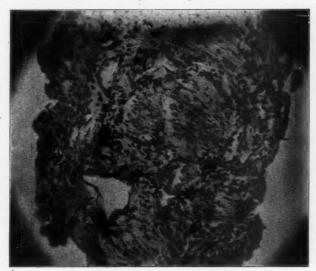


Fig. 15. X 45.

the pulp undergoes repair. This is observed in the teeth of animals where the pulps are large at the foramina. Especially is this true in the pulps in the tusks of elephants and other animals. Lymphatics are, however, to be found in these pulps. While I have never been able to demonstrate lymphatics, oval spaces occur in many pulps, which spaces possess different sizes and shapes, some perfectly round but in most cases flattened upon the sides. They are without walls. Figures 14 and 15. Their exact nature is uncertain. It is true, however, that septic material and microorganisms are carried from the pulp into the glands of the neck. Dr. Korner Halle of Berlin

(Items) by an injection of Prussian blue into the tissue of the pulp proved that the particles could find their way from the pulp into the glands. He experimented upon dogs, by exposing the pulp, painting in Prussian blue, and cementing the cavity. Two or three days afterwards the dogs were killed and the pulps of the teeth as well as the submaxillary glands examined with the microscope. Particles of the Prussian blue were found throughout the pulp to the apex of the root and also in the lymph glands. This then should be sufficient proof that if lymphatic glands are not present nature has never-



FIG. 16.

X 450.

theless provided means for the care of the pulp in disease. That pulps do repair themselves by two methods, lymphatics or no lymphatics, is certain, however. Miller (International Dental Journal, September, 1903) mentions a case described by Gysi and records three cases with illustrations which have occurred in his own practice in which the human pulp after being diseased has thrown out secondary dentin and repaired tooth decay. The pulp was restored to health.

I shall here call attention to this beautiful illustration, Figure 16. At A, diseased pulp in which is seen a circumscribed area of acute

inflammation about to liquefy and form an abscess; C, a fully formed abscess, and B, the cicatricial tissue of an old abscess, showing conclusively that restoration of a diseased pulp is possible. Speaking of want of lymphatics in the pulp Miller says, "It is for this reason that an abscess or center of inflammation the size of a pinhead in the pulp of a human tooth may cause excruciating pain, while its presence on the surface of the body might escape notice altogether." This, however, is not often the case. I have shown that in neurasthenia, hysteria, degeneracy and many diseases the peripheral nerves lose their sensation and hence little or no pain is experienced. Lymphatics are not connected with sensation except as to relief of pressure, but nerve disorder readily interferes with transmission of pressure symptoms, necessary to constitute pain.

FIRST MOLAR EXTRACTION DURING CHILDHOOD, AND ITS RELATION TO OCCLUSION AND PHYSIOGNOMY.

BY MILTON T. WATSON, D.D.S. READ BEFORE THE MICHIGAN DENTAL ASSOCIATION, JULY 7, 1903.

Were this subject one of less importance, and were it not for the fact that it is one greatly misunderstood, I should feel some embarrassment in presenting it for your consideration, as it is one that I have spoken upon whenever opportunity has presented for me to utter a protest against it. I believe it to be the real curse of dentistry the world over. I also wish it to be understood that there has been no special effort made to find new arguments opposing the extraction of first permanent molars, for the reasons which have long been known are more than sufficient to convince any thoughtful student or close observer that the operation is always attended with evil results. I shall quote freely from current literature, as well as from former papers of my own.

A large number of the slides which I shall use to substantiate my position are shown through the courtesy of Dr. C. M. Briggs of the University of Michigan, who prepared them with great care and for the sole purpose of showing what actually happens when first molars are extracted. [Only a limited number of the slides used in connection with this paper are here shown.—Editor.] They are shown here for the first time, and an examination of the models from which

these slides were made will absolutely convince any man who is broad enough to be open to conviction, that the operation should be forever stamped as malpractice, except it be performed under conditions which would justify an amputation, were the organ under consideration a limb instead of a tooth. That these organs may be lost among the submerged classes is to be expected, but this can never excuse a man for advocating extractions among that class which comes to him believing in his greater ability to decide such matters for their best interests.

I have only the kindliest feelings for those distinguished gentlemen who extracted first permanent molars at a time when laymen had not learned the need of dental attention for their young children, and when the treatment of exposed pulps and especially abscessed teeth was a thing little understood and usually followed by disastrous results. These difficulties have very largely disappeared at this time—in fact, almost completely among the so-called "better class," for they know and appreciate the value of the dental apparatus—and it is our solemn duty to see that the laymen who have not yet reached this stage of refinement are given true light upon the subject when such light is sought, for who knows but that it shall be from among these that great singers and orators of the future may come?

The arguments in an article by Dr. W. Mitchell of London are a fair type of those advanced by the men who advocate this practice. He says: "The points I wish to bring out for your consideration are why and when shall the extraction of the first permanent molars be performed? * * * I purpose by my deductions, based upon experience, to convince those who have heretofore been opposed to the extraction of these teeth that we have a practical and legitimate means of preventing to a great extent the ravages of dental caries, especially that form produced by lateral pressure, and the securing of a more serviceable dental armament by the more perfect safeguarding of the interproximal space than is possible by flat and imperfectly-contoured fillings; and later by affording patients a more perfect masticating surface; and last but not by any means least, the satisfaction of securing to patients in the most practical way probable immunity from constant and prolonged dental operations during the greater part of their lives."

On the supposition that such practice is based upon false philosophy (that it really is, I shall later attempt to prove) it is our

duty to counteract these teachings so far as possible, for it is a truth too well known to need elaboration that dentists who are not surrounded by an encouraging professional environment, and who are not thus stimulated to do their very best by the fear of being outclassed by their colleagues, fall easy victims to "these easy methods of practice," and excuse themselves with the thought that certain prominent dentists of whom they have read do the same thing.

In answer to Dr. Mitchell's question, "Why and when shall the first permanent molars be extracted?" I would return the flat and definite answer, *never*, when it is possible to save them, and it is assumed that teeth with exposed pulps or even abscessed roots would not be looked upon as worthless unless every possible effort to save them had been attended with failure.

If it were true that "the extraction of these teeth is a practical and legitimate means of preventing to a great extent the ravages of dental caries," then the man given to ridicule might be excused for carrying this same "philosophy" a little farther and advocating the removal of all the teeth, and thus absolutely prevent caries, malocclusion, toothache, facial neuralgia, pyorrhea, abscesses of dental origin on the face and neck and the scars resulting therefrom; in fact, the complete eradication of all the unpleasant things that ever happen to us as a result of trouble with our natural dental organs. But seriously, at the present time none of us needs to suffer any great hardship because of caries associated with "lateral pressure and flat surfaces," for if it is a case where occlusion even approximates the normal there will be comparatively little difficulty in securing sufficient separation to enable a skillful operator to properly contour the surfaces, and if the case is one where this is not possible, then it is evident that the arrangement of the teeth is sufficiently bad to demand that they be straightened. As to this operation safeguarding the interproximal spaces, no greater blunder was ever made. I tell vou nothing can guard that more surely and completely than a proper arrangement of the teeth, which, as you all well know, allows a perfect union of the gum between the teeth from the lingual and buccal sides, and yet the contact of the teeth above it is such that the heavy pressure of mastication fails to crowd particles of food between the teeth. The guarding of these spaces is unquestionably one of the most important things, so far as the future comfort of the patient is concerned, and it can

be successfully accomplished only by the practically normal arrangement of the normal number of teeth, some possible exceptions being cases where third molars can be sacrificed without apparent injury.

If this is an operation of such lasting benefit, and if it is true that it does not influence the development of the face and the jaws, will some one please tell me why it is that the men who advocate first molar extraction always insist upon the removal of all four of these teeth? The real truth is that the development of the jaws is involved. If only the lower molars are taken out a most perceptible shortening of the lower jaw will result, and the effect will be noticeable not only in the occlusion but also in the facial lines. On the other hand, where only the upper molars are removed the lack of development is quite as perceptible as in the case of the lower jaw, in some instances even allowing the upper incisors to close in lingual relation to the lowers. The cases where these results do not follow to a greater or less degree are where the cusps of the teeth are well defined and the occlusion sufficiently accurate that the occlusal contact will carry forward the teeth of both jaws in harmony as development takes place, and in these cases we often find that the space where the molar was extracted does not close up completely. With the above facts in mind, and their indisputable accuracy always borne out by a careful examination of models, I fail utterly to see how any sane man, who professes even the average amount of ability to observe closely, can attempt to make us believe that this operation does not influence the development of the jaws, and no one would have the effrontery to say that the facial development is not always involved if the jaws are really underdeveloped. With the very apparent interference with the development of the jaw in cases where the extraction is confined to either the uppers or the lowers, it must be perfectly clear to any thinking man that the so-called "better results from the harmonious extraction" of these teeth is due solely to the fact that there is an equal lack of development in both jaws, and not to the fact, as Mitchell and others maintain, that there is no interference with their development.

The greatest evil to the greatest number as a result of this operation is perhaps the impaired masticating ability. This is due not only to faulty occlusion but also to the fact that this much-talked-

about "interproximal space" is not properly safeguarded, as I will convince you later on when the projections are thrown upon the screen. I have seen these cases after extraction where, because of the lingual inclination of the remaining teeth, no lateral motion of the jaw was possible, the victim being compelled to "hobble" through the act of mastication by a simple up-and-down movement of the jaw.

The diminution in the size of the jaws as a result of these extractions may and in certain cases does work grave injury to the individual, even to the extent of barring him from certain vocations for which he was fitted by nature. To begin with, the facial appearance must certainly be involved. Not a few are the times that I have seen young women with that peculiar deficient development in the region of the mouth, caused by these abominable extractions, who would otherwise have been types of striking beauty; and these same individuals were handicapped in their speech because of the lack of room for a free and normal use of the tongue. Think, gentlemen, how easily you can destroy the chances for a famous stage career. These conditions which interfere with the voice of the singer or actress are equally disastrous to the man who is by nature fitted for the lecture platform, the pulpit or the law. I happen to know personally a clergyman who is conceded to be one of the most profound thinkers and earnest workers in the great church which he represents, but who is so handicapped for want of room in his oral cavity, which want is associated with the loss of first molars and some other teeth as well, that his pulpit utterances lose greatly in their force, and he suffers keenly from an ever-present knowledge of his weakness. Are not such cases sufficient to cause us to stop and think seriously before we perform these operations?

The best results I have ever seen, where the first molars have been sacrificed, are in the case of a young man now some twenty years of age, and yet even here his grinding capacity is greatly lessened, notwithstanding the fact that the spaces are well closed, but what is even more noticeable is the fact that his speech is decidedly indistinct. The teeth are also showing decided wear. The first molars have a most important bearing in determining the "length of the bite," and if the normal arrangement here is broken up and the jaws come closer together than nature intended, the oral space is of course lessened as a result and the lines of the lips, from a

purely esthetic standpoint, must be marred. In these cases the lower incisors are not infrequently seen to strike against the gum along the linguo-gingival line of the upper incisors, and while they have been working their way up to this point they have often at the same time forced the upper incisors forward at such an inclination as to make them appear very unsightly, ofttimes spaces appearing between them.

There is another point to which I would call your attention and to which I find no reference in the literature. We all know that when normal function is interfered with the evil results may be very far-reaching, and while actual dissections have not as yet been performed to substantiate what I am about to say, it is nevertheless

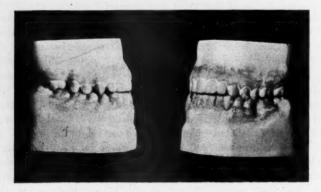


FIG. I.

not at all unreasonable to believe that when we so effectually interfere with the development of the jaws and face by the extraction of these teeth we may at the same time interfere with the development of the maxilla proper, and through its influence with the development of the nasal passages and consequently with normal respiration. If this be true, debilitated constitutions and even fatalities may occur from infections which result from mouth-breathing, and they might not have occurred had the inspired air passed through the filtering process to which it would have been subjected had it been inhaled through a normal nose instead of the mouth. In cold print this danger may seem a little far-fetched, but to bring the matter nearer home, who among you stands over a patient suf-

fering from a contagious disease without closing his lips tightly for the purpose of compelling nasal respiration? Why do you do it? Some, because of their knowledge of the protection the nose thus affords; others, because of the promptings of nature, of which they may be unconscious—instinct, so called.

There may be those among you who are not willing to believe that the above-named conditions are really a source of danger to patients, but whether you are ready to accept that or not, you cannot gainsay that where nasal trouble already exists, and where the jaws are sufficiently inharmonious in their mesio-distal relations to make it necessary for the patient to put forth a subconscious effort in order to close the lips, the loss of the lower molars, or

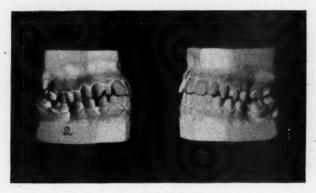


FIG. 2.

even one of them, yes, even a bicuspid, would certainly put the patient in condition where mouth-breathing would become permanently established.

There are still many things that might be said in condemnation of the extraction of these teeth, things which are more apparent to the man viewing the situation from a purely dental standpoint, but these are apparent to any observer, and will be dwelt upon momentarily as we go over the pictures together.

Fig. 1. Man twenty-one years old. Upper first right and lower left molars extracted at thirteen years of age. The condition of the teeth makes it apparent that considerable development of the jaws, for the accommodation of the second molars, had taken place before the extractions, and that instead of the second molars coming

forward and closing up the spaces produced by the extraction of the first molars, the bicuspids have drifted backward, destroying the occlusion and leaving the interproximal spaces unguarded.

Fig. 2. Boy nineteen years old. Lower molars extracted at thirteen years of age, resulting in an almost complete destruction of the occlusion, and showing a not uncommon result of the extraction of first permanent molars after the jaws have developed for the accommodation of the second molars.

Fig. 3. Man twenty-four years old. Upper molars extracted at twelve years of age. The cusps of these teeth are short, hence there is a short over-bite, and this allowed the incisors as well as

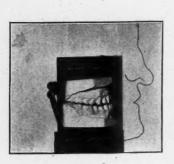


FIG. 3.



FIG. 4.

the bicuspids to drift backward. The result is a greatly impaired masticating apparatus as well as marked facial deformity.

Fig. 4. Lower molars extracted at twelve years of age. The lower jaw failed to develop in length along with the upper, the result being of course a receding lower jaw and a pronounced facial deformity, to say nothing of the interference with the masticating capacity of the individual.

Fig. 5. Boy, age twenty. Upper molars extracted at nine years of age. The lower jaw developed normally along with the eruption of the molar teeth, while the upper jaw failed to develop in length because of the loss of the first molars, the result being a pronounced facial deformity as well as the destruction of the incising function. Note how the distortion of the facial lines corresponds with the inharmony of the occlusion. Had the lower molars

been extracted at the same time the uppers were, there would have been an equal depression of both lips, which shows that the removal of all four first molars does influence the development of the face.

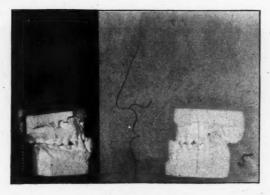


Fig. 5.

Fig. 6. A girl whose lower molars were extracted at fourteen years of age. The teeth in front of the spaces formerly occupied by the first molars have drifted backward, and the second and third

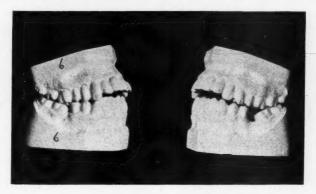


Fig. 6.

molars have tipped forward and lingually, resulting in a crowding of all the teeth and the destruction of the interproximal space. The influence upon the position of the teeth of both jaws has been very pronounced.

Fig. 7. Girl, age twenty-three. Upper and lower first molars all extracted at twelve years of age. It is evident that at this age the second molars had advanced sufficiently to have caused considerable development of the jaws, hence the scattering of the teeth



Fig 7.

after the removal of the first molars, destroying in a great measure their usefulness as well as their appearance. The interproximal spaces are utterly unprotected, notwithstanding the fact that the first molars were all extracted at a so-called "favorable age."



Fig 8.

Fig. 8. Boy fifteen years old. The first molars were all extracted at ten years of age. The picture shows most conclusively that the masticating ability of this individual is greatly lessened and that the interproximal spaces amount to "gaps," or "receiving

stations" for large quantities of food which pack against the gums with such force as to be decidedly uncomfortable. This patient is the last one for whom I ever extracted the first molars, and while



Fig. 9.

I believe the result to be better than the average, it is still so imperfect that it will be a source of life-long discomfort to the boy, should he retain the teeth that long.



Fig. 10.



Fig II.

Fig. 9 represents one of Dr. Mitchell's own cases, in which the child was eleven and a half years old at the time of operation. The model shows the case three years after treatment. When I

am shown such a model as this, and am asked to believe that the interproximal spaces are safeguarded, and that the masticating ability of the patient is not interfered with, I feel that I have some reason for questioning the scientific accuracy of the deductions on the ground that the man is not a close observer. The facts are that the thorough mastication of food with such an occlusion is a physical impossibility.

Fig. 10 shows another of Dr. Mitchell's cases at the age of about ten and a half years, at which time the upper first molars were extracted. Some months elapsed before the lower molars were extracted, and on account of this delay the occlusion has been modified as compared with the other case, so the Doctor tells us.

Fig. 11 shows the same case five and a half years after the extraction of the upper molars. The Doctor seems to be, in a degree at least, satisfied with the result in this case, for he says that during five and a half years only two small fillings were required and that the present condition of the teeth is good. My sympathy goes out to the men who are so misled by their biased opinions that they fail to see the real result of the unfortunate extraction of these first molars. The mere fact that only two small fillings have been required in more than five years in one of Dr. Mitchell's cases is indeed a small thing when one stops to consider at what a tremendous cost to the masticating capacity of the individual it has been secured.

SOME PHASES OF PYORRHEA ALVEOLARIS AND ITS TREATMENT.

BY GEO. W. COOK, D.D.S., CHICAGO. READ BEFORE THE MICHIGAN STATE DENTAL ASSOCIATION, JULY 8, 1903.

It would be interesting as well as profitable to give the conceptions heretofore held concerning infectious diseases, but such a history would be impossible in one brief paper; suffice it to say that all diseases of which we have any definite knowledge are looked upon as micro-parasitic processes.

In local disease processes there is one of three changes always taking place in the tissue cells, either a regenerative, degenerative or necrotic change. In pyorrhea alveolaris we have the regenerative and the necrotic changes. The degenerative process is the one most commonly observed in certain phases of pyorrhea. However, this

particular phase can not easily be separated from both the other changes that take place in the tissues, namely, regeneration and necrosis.

Since all local pathological changes in tissues are believed to be due to some external exciting cause, pyorrhea alveolaris must necessarily be classed as springing from the action of bacteria and their products.

Pyorrhea alveolaris belongs to that class of diseases to which only a limited number of individuals seem to be predisposed, as is the case with rheumatism, gout, actinomycosis, cancer, etc., all of which are looked upon as belonging to a class of specific infectious diseases. The question might be asked, why do not all diseases attack all mankind, seeing that they are everywhere disseminated? This question can be answered only by stating that microorganisms are not always constant in their pathogenic properties; neither are the tissues and the cells of the body at all times endowed with the same predisposition to the exciting cause of the disease, which may be or is looked upon as being some external agent. In the mouth germs live in an environment subject to sudden and extreme changes. The saliva is a solution containing chiefly the electrolytic salts, sodium, potassium and magnesium ions.

Since it has been thoroughly demonstrated that the life of the protoplasm, as exhibited in its irritability, depends upon the proper qualitative and quantitative relations of these ions in the environing solutions, it is easy to understand how a change in the composition oi the salts of saliva will affect the physiological phenomena of bacteria. Should the change in the saliva be of such a nature as to lessen the irritability of bacteria, their disease-producing qualities would necessarily be diminished. The ionic constituents of the environing fluids of the protoplasm become changed in the tissues of the body in such a way that the resisting power to bacterial invasion may become lessened; consequently, the irritating quality of the bacteria and their products remaining the same, they may become irritating factors, and after a considerable length of time bring about that peculiar, slow, degenerative process so frequently observed in pyorrhea alveolaris, where we do not have that active necrotic change which is sometimes observed in the formation of pus.

In this slow degenerative process the tissue must come in contact with a poison, and the primary reaction being that of increased irri-

tability, the increased activity of the affected tissue is of a protective tendency. Such poisons always give rise to the so-called inflammatory phenomenon, namely, a gathering of the leucocytes and tissue cells to the affected area or toward the offending agent. If the offending agent is not of sufficient strength to destroy the tissue elements as fast as they accumulate the agent is soon destroyed or rendered ineffective. Here the internal resistance is greater than the external cause (bacteria).

It must be considered, however, that inflammation and degeneration completely break down and the nuclei of the cells become suspended in serum, and with the dead tissue cells form a necrotic mass, therefore necrosis is not a process but a result of inflammation and degeneration. The term applied to the process previous to the complete breaking down of the tissues is known as necrobiosis; which means a reparative tendency on the part of the living cells and a struggle on the part of the offending agent to overcome the internal resistance of the physiological forces of the tissues of the body.

Up to the present time the study of bacterial forms and their classification has been in accordance with the morphology of these unicellular forms, losing sight almost entirely of the chemical factors in the causation of bacterial diseases, a condition that can no longer be ignored, for it is a well recognized fact that many of the disease symptoms which make their appearance in the higher animal organisms are due to the chemical activity of the bacterial cell, and in the majority of instances these general symptoms arise from some local bacterial process. This is well illustrated in the diseases known as diphtheria and tetanus. In both instances we have a local degenerative process in which the bacteria themselves seldom if ever enter the general circulation, but during their activity they form an intercellular bacterial substance that has an elective affinity for the general nerve centers, which bring about certain well defined clinical symptoms of these diseases.

In pyorrhea alveolaris we have a local degenerative process in which there are constantly present numerous bacteria, and in some instances it may be necessary for there to be present more than one form in order that the diseased condition manifest its true type of meaning, which is pus in the pockets. This term is known as symbiosis, a condition in which there is more than one bacterium present during the general activity of the disease.

It is a well established fact, however, that the pathogenic bacteria have the power to incite disease, and some of them have the ability to lead a saprophytic existence with other organisms. Consequently all the rules laid down by Koch cannot be definitely complied with in all diseases. Victor C. Vaughan has said that every germ causing disease in man does so by its chemical product. In pyorrhea alveolaris we have a local degenerative process of certain elements which always takes place in a definite kind of structure, and when this tissue has been removed, as for instance, the tooth, complete recovery from the disease takes place, and most of the constitutional symptoms disappear. Therefore it is fair to presume that pyorrhea alveolaris is a specific disease process of local origin, and all general symptoms are the result of the absorption of products of the local process.

It has been my privilege to study a number of these cases in which there was every evidence of a general constitutional disturbance. Taking cultures from the pyorrhea pockets and allowing them to grow from twenty-four to forty-eight hours in various forms of culture media, and especially in one containing no proteid substance, and filtering out the bacteria and injecting from day to day small quantities of this culture medium into animals, I have been able to bring about general constitutional symptoms of languor, and the animals eventually became emaciated and in some instances died. Some would live for a considerable time, and when the injections were stopped they would in a short time return to their general diet and soon recover. Controlled animals were used and injected with the same quantity of the solutions in which no bacteria had been grown. This was done in order to determine if the solution as prepared for the food media for bacteria had a deleterious effect upon the animals. None of the controls was affected by the solution. It would be quite out of place for me at this time to attempt to discuss the chemistry of the media in which these microorganisms grew; suffice it to say that the culture media injected into animals were rendered neutral before injection.

The evidence here obtained is sufficient to demonstrate conclusively that many of the symptoms of a constitutional nature that are manifested in pyorrhea alveolaris are due in most instances to the pyorrheal infection. There may, however, be some conditions where the constitutional manifestations are established before the typical and well-defined symptoms of the local pathological condition have be-

come well defined; for instance, there may be poisonous substances formed in the intestines during external digestion which exert their influence after being absorbed into the body through the intestinal wall, thus bringing about the predisposing factors to pyorrhea alveolaris.

I have elsewhere discussed at considerable length those conditions that seem to be very important factors in the etiology of pyorrhea alveolaris, and when we have clearly in mind the various factors that enter into the etiology of this morbid process, the treatment must be based upon our conception of the true causes that enter into this condition.

I may here speak of the treatment of that phase of pyorrhea in which we have but little pus formed, but where there is a slow degeneration, forming deep pockets along the side of the root, in which there is firm attachment of the peridental membrane, possibly a half or two-thirds around the root. In such cases the disease has not been observed by the patients and they have suffered but little inconvenience, consequently, there is a number of teeth around which the pockets have been established without any knowledge or annoyance to the patient. On close inquiry it will be learned that the patients have suffered from no constitutional difficulties, and they will claim that the appetite and digestion are fairly good. These persons are many times of a robust nature and are commonly supposed to be in a healthy condition. In the more advanced stages of pyorrhea in these cases it will be found that the disease is not so controllable in winter as in summer, especially among those patients who are confined to an indoor and sedentary life; the appetite and digestion are usually good, but in most cases there is a lack of proper activity of alimentary digestion and elimination.

In such cases there is an accumulation of both saprophytic and fermentative bacteria in the intestinal tract; these agents being much more active in the process of breaking up certain foods, like the carbohydrates, which are essentially digested in the small intestines. The energy that under ordinary circumstances is extracted by the small intestine from carbohydrate food is materially increased by certain forms of bacteria that may pass down through the stomach and into the small intestines. The albuminous digestion may likewise meet the same fate by being thus converted into a substance out of which the nutrition of the body has been robbed of some of the

most essential constituents for keeping up the physiological equilibrium of the body. All food media may be so interfered with as to render them quite invaluable to the body nutrition, and in this way are brought about many of the forms of predisposition to local infection.

I have elsewhere called attention to these various forms of interference with the physiology of digestion and nutrition, and how same may be used as a means of bringing about predisposition and immunity. Suffice it to say here that the various means of changing the body from extreme immunity to a state of susceptibility are so varied that time and space will not permit us even alluding to the many factors; in some cases it is possible to determine all and in others only so many as are consistent with the possibilities of the case in hand. It is not possible to determine the many factors that enter into the typical physiological functions of the body, and still less the many things that may interfere with the functions of the various organs and tissues.

The local conditions, such as the extent and number of teeth involved with this slow degeneration of the peridental membrane and its adjacent structures, are of the very first importance. If there be pus, determine so far as possible the comparative quantity in the twenty-four hours; the extent of the deposits on the roots of the teeth, if they should extend, for instance, two-thirds the length of the root with a loss of considerable alveolar process. In such cases it is possible under favorable constitutional conditions to bring the teeth into a healthy state and have these remain so for an indefinite period. One of the important processes in the treatment of such conditions is the removal of the deposits. If they happen to be of a soft, gelatinous consistency their removal is of course very simple, but in cases where the peridental membrane is diseased far beyond the extent of the pocket it is necessary to lacerate and break up this pathologic structure. This can be done without any special pain by the use of a local anesthetic (and for that purpose I have found nothing that answered better than acestoria). As an agent for disinfecting in these particular cases there is nothing better than some of the organic acids. Lactic acid is used by many with good results. It is non-escharotic and penetrates deeply into the surrounding tissue. I have incorporated in lactic acid some of the metals, making a lactate of silver and copper, and have come to the conclusion that the lactate

of copper is more beneficial than the pure lactic acid. The number of applications of any of these agents depends upon the conditions and the extent of the infected area. Sometimes it is necessary after the deposits have been thoroughly removed to go into the parts and set up an acute inflammation by mechanical means in order that the tissues may become actively hyperemic; in such cases there has been established an active local leucocytosis, and this brings about regenerative activity.

Another phase of pyorrhea that is very closely allied locally to the conditions just described is where there is considerable deposit on the root of the tooth, very firmly attached and of the consistency of a hard, calcareous mass. In such conditions there is usually more extended necrotic condition of the tissue; there is generally a bluish tinge at the margin of the gums, which sometimes will be observed to follow almost the length of the root. It frequently happens that it is a difficult matter to get an instrument into the pocket, especially one that you can operate for the removal of the deposits. In such cases it may be necessary to inject a local anesthetic and split the gum the full length of the blue line, removing all the deposits and dressing the case surgically for a few days and then allow the gumto heal up. In these cases, as a rule, the disease process is confined in the early stages to a few teeth, there sometimes being but one involved. If it is possible to get into the pockets without splitting the gum the deposits are removed and a line of treatment that has given the best success in my hands is used. After removal of deposits I used a preparation known as phenol sulfonic acid. This preparation is made by combining equal parts of crude carbolic acid and crude sulphuric acid. It is a very active antiseptic and has the peculiar power of penetrating deeply into the tissue that is undergoing the degenerative process, especially in cases where there is destruction of bony tissue. It has a chemical action on the deposits, and many times assists in loosening them so that their removal is much more easily effected. Two or three applications of this agent are sufficient after the deposits have been surgically removed. During the operation of removing the deposits every surgical precaution should be used, avoiding as far as possible the use of any agent that is an oxidizer or an escharotic, both of which leave the tissues an easy prey to the action of the microorganism. A warm salt solution should be

kept at hand, and during the operation the pockets should be vigorously irrigated with this solution.

After the operation of removing all deposits has been effectively executed under aseptic conditions, and the treatment followed out as herein set forth, upon such teeth where the pathological degenerative process has been extended over two-thirds the length of the root and more than one-half of the circumference of the root, the restoration of the tooth to a useful condition is very hopeful; but that predisposition of the individual must also be removed, otherwise local treatment can be only temporary. This predisposition may to a large extent be a local one, in other words, we recognize that the provision of food for the certain production of bacterial energy rests very largely with the bacterial environments.

A normal saliva under certain circumstances, mixed and mingled as it is with other nutritional properties, may be sufficient to increase the pathogenic properties of a bacterium to its highest efficiency, and circumstances making it possible for microorganisms to find a lodgment under the free margins of the gum, they set up a degenerative process of the tissue cells with which they come in direct contact, and eventually establish the well-defined symptoms that accompany pyorrhea, very few of which are ever observed in the early stages of the disease, unless there has been some long-continued organic disturbance of the body. In such cases they are only predisposing factors, and it is possible for them to have but little influence on the real virulent properties of that microorganism which is constantly present in this disease. On the other hand, an organic disease may change the saliva in its electrolytic properties in such a way that it may act favorably or unfavorably upon the protoplasmic structure of the microorganisms present in the oral cavity. The biological factors that enter into all disease processes are at the present time in more or less obscurity, and especially those diseases where there are present local as well as general manifestations.

At the present time the biological phenomena of pyorrhea alveolaris rest upon two factors: first, that it exists in the animal economy as a predisposition which may be inherited or acquired, and second, that bacteria are the exciting cause. When these factors are taken into consideration, and the exact bearing that the one has to the other, both from a clinical and scientific standpoint, and the treatment fol-

lowed out in accordance with the physiological lesion, pyorrhea is amenable to treatment under favorable circumstances.

Discussion. Dr. J. Taft: A large proportion of the teeth once affected with this disease are doomed. It begins in an insidious way, attacking one tooth and then another until by and by the entire jaw is affected. Sometimes it appears simultaneously by attacking all the teeth and running its course rapidly and with disastrous consequences. Usually the teeth loosen one by one and take on inflammatory processes which hasten their extraction. Treatment in some cases seems futile, and no known treatment is a specific in all cases. The pathology of the disease is so varied that no one could give it in so short a time. The essayist has given one aspect lucidly, but it would require a volume to give the complete history and treatment of every form. In my judgment constitutional conditions play a very important part in the development and control of it. Patients even show variations in the more localized incidents. It does not run the same course with all patients, and all do not react similarly to the same treatment.

Local factors are always present, either of a mechanical, chemical or microbic form. It is a curious fact that the disease does not always attack the entire tooth environment, but, as cited by the essayist, it may extend laterally over a small area of the root, but deeply towards the apex. Why this should be is not always easy to determine. It may be due to the kind of infection present or to some aberration in embryonic development of the peridental structures rendering them more susceptible in certain areas. At times we meet cases in which the process is painless, and still others in which there are excessive sensitiveness of the roots and more or less neuralgic or inflammatory pains.

My own opinion is that it is essentially a disease of the peridental membrane rather than of the gum tissues. There is almost always a degeneration of the peridental membrane, while the associated gum may retain an unusually normal condition, but of course as the disease progresses the gum inevitably becomes involved, although the overlying mucous membrane is seldom seriously affected. A proof that the disease is peridental is that when the teeth are extracted healing occurs without delay. The treatment will always vary with the manifestations. If there is suppuration or necrosis, disinfection of a surgical and chemical character is indicated.

Dr. C. H. Oakman: We should know the pathological conditions that exist in order that we may apply proper treatment, but it is not always necessary that the etiologic history be known. I have had excellent results from the use of lactic acid, especially in necrotic conditions and where an escharotic remedy is not contraindicated. It, however, usually causes considerable absorption, as it destroys and shrinks the tissues. In scaling and operative procedures I do not like to destroy the gum septa, but see no objection to making the incision over the root as recommended by the essayist. This would not be likely to prove detrimental by causing absorption and would readily heal. Use small, thin instruments so as not to mangle the gum unduly.

I have a patient who is a hard drinker, and when he came to me twenty-seven of his teeth were badly affected, with considerable gum recession. The patient was urged to moderate his bibulous habits, and the treatment was undertaken. The first operations were made to remove the deposits, and it became necessary to cut through the gum substantially as the essayist recommends. The teeth were thoroughly cleansed of all deposits after several sittings. After three months' treatment the gums are in good condition and the patient has comfort where before he suffered much pain. It has

required constant care on both my part and his.

My method is to first thoroughly cleanse the teeth surgically and mechanically, then I disinfect them, usually with hot solution of chloretone, which is a good anodyne antiseptic used hot. I make a supersaturated solution in a test tube and use it while still as hot as the patient can stand. It sterilizes the operative field and eases the pain so that further sealing may be done comfortably if necessary, and it leaves a stimulating influence as it is absorbed. If the gums are congested at the first operation I bleed them freely. In addition to local treatments which will be suggested by the symptoms which develop, I instruct the patient to massage the gums two or three times daily with the fingers or with the brush when cleansing the teeth. If there is an acid reaction to the secretions of the mouth I would use some good alkaline antiseptic. If the teeth are affected it is desirable that they be put into a splint to hold them in their normal position with the least amount of change from the force of mastication, which is likely to prolong the irritation and may result in the loss of the teeth.

Dr. C. H. Worboys: I find it very desirable to control the hemorrhage as well as the pain in any kind of surgical work upon the teeth. I have found nothing better for this purpose than a two per cent solution of cocain in adrenalin. If it is necessary to bleed the gums I wait until after much cleansing is done, and then if it is still called for make liberal incisions so as to keep up the withdrawal of blood for several minutes. My method is to first thoroughly clean the teeth, disinfect the surrounding or implicated areas, and then apply antiseptic or curative treatment as indicated.

Dr. E. B. Lodge: There are two treatments which have not been mentioned that I have used with good success. One is the decomposition of remedial agents at the seat of the disease by electrolysis. This may be accomplished by packing the pockets first with crystalline substances and decomposing them with an electrode, or by use of an electrode made of a metal or alloy which will be decomposed by the current or chemical generated at the point of contact with the diseased structures. The other is the use of the X-rays applied directly to the tissues affected. This of course re-

quires special apparatus and skill.

Dr. N. S. Hoff: It is practically impossible for any one to treat all cases of pyorrhea by the same methods and get successful issues. There are wide differences as to cause and conditions, including systemic and habitual circumstances, which are never the same in two cases. While it is possible to conclude that the disease has certain phenomena that are more or less constant and common, there will be sufficient differences in individual cases to make it necessary to modify any course of treatment to meet same. We must be able to diagnose the condition met and determine as far as practicable its peculiarity before we can intelligently apply treatment. Then, again, any treatment will necessarily have to be watched and varied to meet the different stages as they develop. Too long treatment of a caustic or alkaline nature may result in unnecessary loss of the soft tissues, and on the other hand, the treatment may be unnecessarily prolonged because the remedy has not been applied in sufficient power to accomplish the required action. The manifestations of this disease are so numerous that great skill and vigilance are essential to overcome it. If we can not determine its etiology, we can note the symptoms, and it will be well if we

follow these carefully and apply our remedies with intelligent discrimination.

Dr. Cook: The study of the etiology especially, and the pathology also of this disease is a much larger subject than most of us imagine. I think I am in sight of some phases of it at least, and I expect from these in time to get a more definite knowledge of its character, and then its treatment will necessarily follow. The oral structures are subject to the same rules which obtain with other tissues. In some mouths, even though there is great provocation to infection, it never occurs; while in others, where great care is exercised to protect the tissues from infection by various sterilizing methods, the disease will run a rapid course. In these cases we can conclude only that there is local predisposition. This of course we cannot change by any form of local treatment alone. Possibly in such cases a complete systemic renovation is required. In addition to our efforts to eliminate all extraneous or local causes the family physician must be called in for complete systemic treatment, including a general toning up of the nutritive processes.

We should of course exercise great judgment in the application of remedies. I sometimes use lactic acid effectively in cases of acute inflammation, but its action may serve to accentuate the disease. Phenol-sulphonic acid should never be used where there is irritable tissue unless you want to destroy it. It is an excellent remedy where there is necrotic structure to break down and disinfect.

It is not likely that the peridental membrane, the alveolar process or the gum tissue are ever developed to their normal condition. The gum may to some extent in favorable locations be made to grow upon the root, but it is repair tissue and has no great endurance under the fierce attacks made by the usual functional activities of the mouth.

EMPYEMA OF THE ANTRUM.

BY O. N. HEISE, M.D., D.D.S., CINCINNATI. READ BEFORE THE SECTION ON STOMATOLOGY, AMERICAN MEDICAL ASSOCIATION, MAY, 1903.

In an article on empyema of the antrum appearing in one of our leading dental journals not long ago I noticed a statement as follows: "Within the last few years a comparatively new affection, frequently confounded with antral empyema, has appeared; dentigerous cysts arise, as you know, about the tooth-roots, and slowly

dilate the tissue at the root of the tooth." I quote this principally to show that affections of the teeth and alveolar process in relation to antral troubles do not receive the attention they deserve. If the author of the article above referred to had taken the trouble to inform himself he would have found that it was not a new affection; also that a dentigerous cyst is a different condition of affairs than he states it to be.

These maxillary cysts, when found in the neighborhood of the molars and bicuspids, can and do in their development raise or push the floor of the antrum to such an extent that finally the thin intervening lamella of bone is resorbed, leaving only the periosteum and the lining mucous membrane of the antrum as a covering. Oftentimes I have seen the encroachment such as to include the entire antrum, filling it completely, in its further development raising both outer and inner wall as well as the roof.

Antral cysts developing from within the cavity must of necessity first completely fill it before they can produce any abnormality in the way of bulging of either wall, and they can be recognized as having their origin from within, instead of having developed with the alveolar process. The facial wall being extremely thin, owing to the resorption of the bone, this leaves at times a decided defect in the wall, whereas in the dental or alveolar origin the thinness of the wall is found to be in the alveolar region or process. They are more frequent than has been supposed, not only in connection with antral lesions, but in other regions of the alveolar process, both in the upper and lower maxilla. Many an abscess has been treated with little or no success, the tooth finally extracted, the socket curetted, packed, etc., thinking it to be a case of caries; whereas, if the proper diagnosis had been made, the tooth could easily have been saved by proper treatment, especially the single-rooted teeth.

The domain of the stomatologist runs very closely into that of the rhinologist. Every now and then in the treatment of an obstinate antral suppuration we find that the trouble is not so much in the antrum as in some of the accessory cavities draining into it, making a reservoir, so to speak, of it, and we are treating only the effect not the true cause in such instances. This fact, and also the frequent occurrence of empyema after la grippe, has led some men to almost doubt the dental origin of antral empyema. There is no question at all in my mind that many antral cases are primarily due to infection

from some accessory cavity or other nasal disease; nevertheless, dental causes are and will remain prominent etiological factors.

The difference of opinion as to the main causation of antral empyema depends greatly upon the viewpoint, reminding one of the Oriental story of the three blind men who went one day to inspect an elephant. "He is like a spear," said one, who grasped the tusk. "He is like a fan," said another, who felt the ear; while the third, with his hand on the leg, declared he was "like a tree." They had all inspected the elephant, but naturally formed different ideas of his appearance. So it is with the etiology of antral empyema, various observers form different views from varying experiences, while if all would inspect each and every case, and judge of its cause and treatment on its own individuality, it would be seen that there is ample room for all opinions in considering this interesting subject.

It is not my intention to enter into a discussion as to which etiological factor, nasal or dental, is most frequently found to be the cause of antral suppuration, but it has seemed to me that of late the dental relationship to antral empyema has been somewhat overlooked, not only being frequently the cause, but having a decided influence in keeping up a certain amount of irritation, thereby preventing a complete cure. I therefore wish to bring this phase of the subject to your notice.

That many affections of the nasal cavity and antrum are due to diseased teeth, etc., is not to be doubted. Not only abscessed teeth, but oftentimes carious, and even filled teeth, especially the superior incisors, are the cause of nasal disturbances. Ziem of Danzig was one of the first to point out the important relationship existing between diseased teeth and abnormalities of the nasal mucous membrane and antral troubles. He reported a number of cases showing that any carious tooth in the superior maxilla, and sometimes even in the inferior maxilla, can and does by reflex action bring about hypertrophica rhinitis, and he sounded a note of warning against the imperfect treatment of carious and diseased teeth, especially the molars and bicuspids. It was due to his investigations that in 1886 the real impetus to the study of antral empyemata was given, showing conclusively that they were far more common than previously supposed or believed, Ziem himself being a sufferer from an antral empyema due to a diseased tooth. He also was the first to designate the trouble as empyema of the antrum, which, however,

is not altogether a correct term, inasmuch as an empyema from a pathological standpoint is a collection of pus in an enclosed cavity of the body. In the so-called empyema of the antrum we have the collection of pus, but not in a completely enclosed cavity, as we have a continual or an occasional discharge of pus from it. It is useless, however, to find fault with the term until we have a better and more appropriate one to apply. Since Ziem's first important contribution to this subject and the other accessory sinuses of the nose. Zuckerkandl's numerous dissections, as well as the work of P. Heymann, Moritz, Wolf, Harke, and others, it has been shown that diseases of the accessory sinuses are anything but infrequent; in fact, they are almost the rule in acute infectious diseases, but fortunately will, if the natural openings are normal and not closed by some diseased condition of the nose, end in a spontaneous cure. That some do not end this way is due, according to M. Schmidt and E. Frankel, "to the varying virulence of the bacteria and the individual disposition of the patient."

It is, however, "rather strange," as pointed out by M. Schmidt, "that the various sinuses, being so frequently affected in cases of la grippe, should show the presence of the influenza bacillus so seldom—only in one case out of thirty, according to E. Frankel's examinations."

Grunewald has well said, "The great frequency of inflammation of the antrum of Highmore, which follows from the anatomic position of the cavities, rendering them liable to infection by the extension of a process from the inferior turbinate, and favoring the isolation of the morbid process within them by the swelling of the surrounding tissues, and by the high position of the orifice above the floor of the cavity, is enhanced by the proximity of organs like the teeth that are so prone to become diseased. Accordingly, infection of the antrum of Highmore, derived from a diseased pulp by way of the lymph-channels, and catarrhal condition due to irritation accompanying coronal caries, are quite common, and inversely, catarrh of the antrum may give rise to periodontitis and thus establish a vicious circle, so that the antral disease persists even after other causes have been removed. As infection creeps along the lymphatics of healthy bone, a focus of infection in the crown of a tooth is by no means to be despised, for even if an empyema of the antrum be due to another cause, yet disease of the

crown of a tooth is calculated to maintain such a state of itritation in the mucous membrane as may frustrate all attempts at a cure."

In an excellent article Grunwald gives interesting and convincing statistics regarding the influence of the teeth in the treatment of antral affections. "In thirty-one antra of twenty patients who had sound teeth, or apparently so at least, thirty-nine per cent were cured, twenty-three per cent almost cured, sixteen per cent improved, and twenty-three per cent unimproved; whereas in twenty-eight antra of nineteen patients, in whom the decayed teeth influencing the condition of the antrum were extracted, sixty-five per cent were cured, seventeen per cent almost so, fourteen per cent

improved, and only five per cent not cured."

Grunwald explains that in cases of those patients having apparently sound teeth there must have been some diseased condition present, in the way of a periodontitis, which was and is often overlooked even by dentists, as he on a number of occasions referred the patient to them, and they refused to extract the tooth or teeth on account of the apparent soundness of same; that the chances of overlooking any connection or influence that apparently sound teeth have in keeping up the suppurative process are much greater; it is easy to overlook a diseased condition of the roots of the teeth. whereas in the cases where teeth were found to be diseased, and either acted as a direct cause of the empyema or were to a certain extent responsible for the original trouble in the antrum, or in keeping up the suppurative process, the extraction of them was alone a prime factor in the cure of the affection, but did not of itself in the majority of cases suffice to bring about a complete cure, inasmuch as the mere puncturing of the antrum did not show any brilliant results. That not enough attention has been bestowed upon this matter is shown by the fact that in a number of cases treated according to the accepted methods of to-day suppuration would persist until the teeth involved in keeping up the process had been extracted, showing conclusively that although they might not have been the original cause of the suppuration, they were nevertheless active factors in preventing a complete cure. He also cites a number of cases to show the important relationship existing between diseased teeth and suppuration of the antrum.

There seems, however, to be a decided difference of opinion between the anatomists and clinicians regarding empyema of dental origin, the former claiming, as no microscopic evidence of any inflammation or change of structure is found upon section of the antrum between the roots of the teeth and the cavity, that the teeth decayed or diseased play little if any active part in its production.

They do admit occasionally to have found sufficient dental cause. Zuckerkandl in three hundred cases could trace only one as being due to dental causes. The same with E. Frankel, while Dmochowsky never found any evidence. Hajek in this connection remarks, "This marked difference of opinion of anatomical and clinical evidence is due to the fact that in the course of time all evidence which would point to a disease of the alveolar process or teeth is entirely lost, as it is quite possible for the germs to penetrate through the alveoli of the teeth and the intervening bony plate, as is the case in an affection of the meninges in frontal sinus and sphenoidal empyema, without leaving or producing any macroscopic changes in the bone."

Kyle states, "Too much importance cannot be attached to the teeth as a casual factor in antral lesions." A majority of cases he believes are due to diseases of the teeth, and gives the percentage as high as seventy; he also states that it may be a post-operative complication of nasal and dental surgery. One case observed by him was due to the use of arsenic applied for the destruction of a pulp in a decayed tooth. The application was made twice in three days, and not seen for several days afterward, when the antrum was involved, and extensive tissue necrosis had occurred with infection (evidently due to a very careless application of the arsenic). In another case extensive necrosis and suppuration had followed the injection of chlorid of zinc into a tooth-cavity which connected with the antrum.

The relationship between diseased conditions of teeth and the upper jaw, gums, alveolar process, and antral troubles, as well as some lesions of the nose, is an intimate one, and should be taken into consideration more frequently than it is, and as Kyle has well said, "A thin alveolar process of upper jaw from lesions of the teeth may cause by extension of inflammation, by continuity of structure, lesions of the floor of the nose or of the antrum; on the other hand, deflections of the septum or spurs situated close to the floor of the nose, by the inflammatory action set up in the surround-

ing structure, may bring about inflammation and diseased conditions of the teeth in the direct line of obstruction."

The stomatologist should therefore have a thorough knowledge not only of the nasal cavities and accessory sinuses, but also of general medicine, and, indeed, the general practitioner or specialist should have a more thorough knowledge of stomatology.

Moistening Root Canals Before Filling.—C. R. Taylor in *Review*. Tyndale's pure oil of eucalyptus is an excellent dressing with which to moisten root canals prior to introducing gutta-percha cones. If also applied after the cone has been placed in the canal, and by employing a blast of warm air the gutta-percha will be easily packed into the canal. Just enough of the oil to moisten the canal is all that is necessary.

Abrasive versus Non-Abrasive Substances for Cleaning the Teeth.—Dr. L. H. Arnold (Review) favors a mildly abrasive powder, flavored and sweetened to insure use, for the following reasons: (1) Some forms of dirt refuse to yield to the brush alone, but do yield readily to the brush and a mildly abrasive powder. (2) The presence of grit in the mouth is distasteful to most persons, and so will insure a most salutary rinsing, which otherwise in many cases would not obtain. (3) A mildly abrasive powder will maintain the polish on fillings, thus prolonging the life of the latter. (4) Every particle of acid of any description which comes into contact with the teeth has a dissolving action on the enamel, leaving it soft, rough and in good condition for the sheltering of hosts of acid-producing microorganisms. This softened portion with its hordes of destructive tenants can be polished off with a mildly abrasive powder but not by non-abrasive substances, its removal making for the preservation of the teeth.

UNERUPTED SECOND MOLAR IN A PATIENT AGED FIFTY-SIX.—By Henry A. E. Canning, L. D. S., England. (Jour. Brit. Dent. Assn.) The writer reports the case of a lady, aged fifty-six, who had suffered from several attacks of influenza two years previous to the date of consultation. After the last attack she noticed that her face was swollen and sometimes painful. She continued in this way for a year, and at the time of her visit to Mr. Canning presented the following symptoms: General depression, deafness of the affected side, pain in the neck on walking, neuralgic pains in the head, more especially in the temporal region, tenderness over the malar bone, with slight edema, accompanied by a sense of fullness, especially when lying on the affected side, disagreeable taste and smell, and constant discharge into the Although she had only one or two incisors remaining, she had never had a tooth extracted, all her teeth having loosened and dropped out spontaneously. After a careful examination by Mr. Canning, in consultation with Mr. Symonds, the diagnosis of an unerupted tooth was arrived at. This was removed with great difficulty, and since then the patient's health has greatly improved.

Digests.

CONTRIBUTION TO THE STUDY OF METABOLISM. By Edward C. Kirk, D.D.S., Sc.D., Philadelphia. Read before the New York State Dental Society, May 14, 1903. In the study of disease one may attack the problem from a variety of standpoints selected with reference to the kind of result, practical or philosophic, which one may desire to attain. Thus the empiric is satisfied with the knowledge of any means which will effect a cure, and is without interest in either the therapeutic principles involved or the etiology of the disorder which he treats.

The complexity of the phenomena presented by morbid vital action, and the extent to which comfortable living and the pursuit of happiness are involved therein, have, however, constantly stimulated investigation into the more occult causes of disease, to the end that in the light of a knowledge of its origin there might be revealed to us the solution of its prevention and successful treatment.

Out of this effort to discover the true solution of disease phenomena have grown the modern methods of laboratory research in pathology and physiology, as well as the immense fund of knowledge comprising the results of bacteriological research as a factor in disease causation. As a consequence of the enormous accumulation of data due to the modern methods of research in medical science, empiricism as a factor in the practice of all departments of the healing art is being rapidly eliminated, so that the practitioner of the present is compelled to equip himself by careful and thorough training in the science of his calling if he would succeed in the rational treatment of disease.

The increasing quest for definite knowledge as to vital phenomena in both their normal and abnormal expressions has wrought and is constantly bringing about changes of attitude in professional thought and modes of practice.

The effects produced upon ancient ideas of pathology by the discovery of the relation of bacteria to disease causation was revolutionary, and the advances made in our conceptions of etiology, with the corresponding readjustment of therapeutics in harmony therewith, have constituted perhaps the most important epoch in medical science. There are, however, evidences that the advance guard of medical research is shifting its ground somewhat for a new point of attack

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upon the problem of disease causation. Bacterial pathology as a science has developed to such a degree that we may now say in general terms that we know how pathogenic bacteria cause disease, and the working out of individual problems in that line concerns simple matters of detail based upon broad and well-known general principles. The new field of research that confronts us is not a question of how bacteria cause disease, but why in certain instances they do not. In other words, the problems of immunity and susceptibility—those conditions of the bodily organism which determine whether disease invasion can or cannot take place—are the burning problems which biological research is now concerned with, and upon which so much of great pith and moment to human health and happiness depends. The problems of dental pathology are simply the problems of general pathology specialized with respect to the territory with which they are concerned, and the same basal principles are common to both.

The Constitutional Factor. It is my purpose to invite your attention to some of the fundamental considerations which it seems to me we must take into account in dealing with the pathological conditions we are called upon to treat in the mouth, and mainly to attempt to clear up somewhat that vexed and much-discussed problem of the constitutional or systemic factor in relation to diseases of the dental and oral structures.

We are all familiar with the wordy warfare that has been waged around the question of whether pyorrhea is a constitutional or a local disorder, and that problem will serve as the pièce de résistance in illustrating the principles which I desire to bring before you. Let me at the outset define the limitations with which for present purposes I shall invest that much-misused term "pyorrhea alveolaris." I exclude for the present all those cases of destructive gingivitis in which the disease is manifestly a filth disease strictly localized in character, due to the impingement of salivary calculus upon the gingival margin, in which the infection is superficial and the resulting inflammation is of the ulcerative type, and which is curable solely by the complete removal of the obvious cause.

The disorder to which I ask your attention is that type of chronic suppurative necrotic inflammation in which the infection of the retentive structures of the tooth is deep-seated, where the suppurative inflammation is of the abscess type rather than the ulcerative, where salivary tartar is not the obvious irritative cause, and where local

treatment alone is inadequate to effect a cure or prevent a recurrence of the disorder, and especially where some error in the nutritional processes of the individual is a constant factor in the case.

I am aware that many of our profession will not be inclined to admit that the constitutional factor of faulty nutrition has any bearing on the local pyorrheal trouble under consideration, but it is for precisely that reason that I have selected this pathological condition as an illustrative one to defend the broad general principle that under normal nutritional conditions the human organism is, broadly speaking, not vulnerable to the invasion of those mouth bacteria which in these pyorrheal patients are the exciters of the necrotic inflammatory process.

We are greatly indebted to the work and observations of Peirce, Talbot, Rhein, and others who have called our attention with much emphasis to the importance of constitutional conditions of malnutrition as predisposing factors in the causation of pyorrhea; for the more closely we investigate the matter and the more intimately we recognize the data of nutrition in its normal and aberrant expressions the more clearly do we see the direct bearing which nutrition exerts upon the phenomena of disease invasion.

Systemic Phenomena in Pyorrhea. From the purely clinical standpoint every practitioner will admit that as a class the pyorrheal cases under consideration are generally associated with certain more or less evident aberrations from normal health. I think there can be no division of opinion as to the fact, so that whatever differences we may have in this connection will be as regards the interpretation of the fact.

It is claimed by certain observers that the ill health of a patient with attendant indigestion, constipation, and bilious attacks, loss of flesh, headache, etc., are symptoms caused by the constant swallowing of pus germs and infected food contaminated with the mouth bacteria and their toxins; therefore, if the mouth be made healthy by local treatment the constitutional symptoms and bad health will necessarily disappear. The reasoning is strictly of the post hoc ergo propter hoc order, and is like the old farmer who said that "down where he lived they swore by Abraham Lincoln and God Almighty," and who was, according to the lamented president's opinion, "only about half right."

Two facts which anyone may verify upon careful investigation

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prove the error of the position of those who regard the pyorrheal condition as the cause of the systemic disturbance. First, the cure of the pyorrhea does not cure the constitutional malnutrition, though we admit at once and freely that the local pyorrheal treatment may and often does improve the general health of the patient. Second, a careful and intelligent investigation of the case will show that the malnutrition was a chronic condition long antedating the pyorrheal outbreak, which is therefore a symptom or indication of malnutrition, and not its cause. The causal relation of pyorrhea to ill health is important in so far as it is an active factor in the production of a so-called vicious circle which intensifies an original constitutional vice.

In the study of malnutrition in connection with lesions of the oral and dental tissues I have during the past year been compelled from the results of my laboratory research to fundamentally reorganize my conceptions of the meaning of malnutrition. I had previously applied that term to individuals who were obviously out of health, or whose subjective symptoms led them to seek relief from some disorder of bodily function. Investigation of a large number of cases by analysis of the saliva and the urine has convinced me that slight impairment and abnormality in the nutritional processes may exist for long periods of time and without producing readily recognizable symptoms, but which nevertheless in due course so lower the vital potential of the individual as to ultimately make him vulnerable to disease invasion, and that in very many instances the disease invasion takes the form of an infection of the supporting structures of the teeth, producing so-called pyorrhea alveolaris.

We have so long been accustomed to the formula "Bacteria cause disease" that we overlook the equally important qualifying fact that they cause disease only when the internal resistive forces of the organism are so lowered as to be unequal to the task of preventing the bacterial invasion. The importance of the vital resistance of the organism as a protective influence against disease invasion has by no means been unrecognized among dental writers, but the magnificent proportions which the bacterial factor in disease causation has assumed in the minds of bacterial pathologists have tended to overshadow and obscure the factor of vital resistance, temporarily at least. The late Robert G. Ingersoll is, I believe, credited with the

remark that if he could have had his way about it he would have made good health contagious instead of disease, and it is beginning to look as if the next step of scientific medical research was to be toward a practical realization of the Ingersollian ideal in that particular.

Modern Conceptions of the Nutritional Process. Let us examine for a moment the modern conceptions of the nutritional process so that they may serve as the preliminary to an attempt at a better understanding of what malnutrition means and how malnutrition may be a predisposing factor in bacterial invasion.

In a broad biological sense nutrition comprises two distinct processes or types of phenomena expressed in that unit of vitality, the living cell. First, a synthesis, or building-up process by which elementary or simple compound inorganic matter is serially constructed into molecular compounds of the greatest complexity; and second. an analytic process by which these highly complex compounds are split or broken down again into simpler compounds, some of which are thrown off by the organism as waste and others rebuilt into the higher compounds, to be again broken down as before. The first or synthetic process we call assimilation, and the second or analytic process we call dissimilation. It is somewhere along the line of these chemical mutations of the contents of the living cell that there is manifested that phenomenon which we call vitality or life, and it is in relation to the harmonious adjustment of the building up and the breaking down, the synthetic and analytic functions respectively of the cell protoplasm, that the highest vital expression, the acme of life potential, is developed.

The building up of cellular protoplasm begins in the plant—in which it has its simplest expression—by the conversion of water and carbon dioxid into starch through the agency of chlorophyll, the analogue of hemoglobin in the animal body. The conversion of the vegetable starch into proteid through the use of it as food by animals constitutes a further synthesis, and in its final expression is the limit of the synthetic process by which the characteristic and highly complex compound, the proteid of animal protoplasm, is developed. It is therefore the production, the breaking down, and the reconstruction of animal proteid which is comprehended in the general term "nutrition" as applied to living animals. As a graphic aid to a conception

of the general factors involved in the nutritional process, Prof. Max Verworn has offered the following formula: Let A represent assim-

ilation and D dissimilation, then when —=I nutrition is normal, but

when $\frac{A}{-} > 1$ or $\frac{A}{-} < 1$ then nutrition is abnormal, the first tending

toward hypertrophy, the second toward atrophy, and both indicating a fall from normal vital potential and a corresponding inability to resist bacterial invasion—if, indeed, the conditions named may not in and of themselves be regarded as disease conditions.

Some New Indices of Faulty Nutrition. I have reported in other papers some results of my study of these constitutional errors in the nutritional process which I regard as the predisposing factors in disease causation, my investigations being largely confined to studies of the saliva and urine in connection with clinical cases of lithemia, arthritism, or that group of disorders dependent upon imperfect oxidation of the cell protoplasm. It is in connection with this condition—the hyperacid diathesis of Gautrelet, Bouchard, Michaels, and others—that we find pyorrhea often as a concomitant local disease. I have already reported the finding in both urine and saliva of waste products which practically demonstrate that imperfect or impaired oxidizing power is the fundamental diathetic fault. In a paper (DIGEST, September, 1903, p. 1126) read before the fifteenth anniversary meeting of the Odontographic Society of Chicago I reported the finding of ammonium cyanate in the urine, and explained its significance in connection with disordered liver function and its importance as a source of abnormal loss of nitrogen with consequent derangement of nutrition. I further explained the mechanism of the loss of phosphorus in cases of so-called phosphaturia and the effects of the phosphorus-starvation thereby induced.

I wish now to call your attention to two other findings which occur in certain malnutritional states dependent upon imperfect oxidation, and which not only develop toxemias but lower the vital standard in pyorrheal cases. The appearance of oxalic acid as oxalates in the urine has long been recognized as a clinical fact, and much difference of opinion as to its significance has been expressed. It is a well-known fact that oxalates may appear in the urine after the

ingestion of certain foods, notably of tomatoes, which are known to contain oxalates in considerable amount, and the presence of oxalates in the urine has been therefore stated to have no significant bearing upon the question of faulty cell-metabolism. On the other hand, it can be shown beyond reasonable doubt that oxalic acid is produced as a side product from the cleavage of uric acid and some of its forerunners in the dissimilation of proteid, and its appearance in the urine in large quantities for a considerable length of time must be taken as an evidence of faulty metabolism.

Heretofore the reported findings of oxalic acid in the urine have been made only when the acid was in combination with calcium as calcium oxalate, in which form it is readily recognized under the microscope by reason of its characteristic crystalline form. I have found, however, in certain cases where the appearance of oxalate of lime in the urine is associated with other phenomena indicating a general faulty metabolism, that the period of the disease is one of well-advanced oxaluria in which the earlier stages were characterized by the loss of oxalic acid as sodium oxalate, a salt which can be optically detected in the urine only by means of the micropolariscope. These oxaluric cases are characterized by nervous manifestations, they are of the irritable neurasthenic type and usually of spare. anemic habit, and where the oxaluria is the index of a chronic faulty metabolism the oxalic acid is excreted in the early stages as a sodium combination followed later by the appearance of calcium oxalates in both saliva and urine.

Another and to me most interesting waste product, which I have recently determined in the urine of two cases of typical malnutrition, is lactic acid in combination as calcium lacto-phosphate and calcium lactate. The fact is well known that lactic acid in large quantities is produced in the organism from the carbohydrate moiety of proteid as a normal part of the nutritional process, but as lactic acid under normal conditions is never found in the excretions its destination in the economy was long a matter of doubt until the investigations of Minkowski threw light upon it. That investigator extirpated the liver in geese and found that thereafter they excreted not uric acid, as is the case with the normal goose, but instead of uric they excreted large quantities of lactic acid and ammonia in the quantitative relations of ammonium lactate; from which result he concluded, doubtless correctly, that ammonium lactate was the fore-

runner of uric acid in the economy, and was transformed into the latter compound through the agency of the liver.

The finding, therefore, of considerable quantities of calcium lactate and lacto-phosphate in the urine of the patients alluded to would strongly indicate a functionally disordered liver, one incapable of converting the lactates into urates. The exact extent of the liver disorder is yet to be determined, but that it exists in pronounced form is shown by the clinical examination as well as by the analysis of the urine.

Faulty Metabolism and Lowered Vitality. These faults of metabolism of which I have given but a cursory account are productive of lowered vitality in two ways: First, by depriving the organism of benefit expressed as high vital potential which is a result of the normal nutritional process; and second, by producing toxic waste products which accumulate in the blood and still further depress the vital resistance of the cellular elements nourished by the toxic blood-stream, and creating thereby a vicious nutritional circle.

It is these two factors—tissue starvation and autointoxication—which to me seem sufficient to account for the lowered vital tone which renders the individual vulnerable to the invasion of those disease-producing bacteria which under conditions of normal nutrition would be—and as a matter of fact are for the most part—harmless. From the viewpoint which I have endeavored to set before you it must be obvious not only that pyorrhea, within the limitations which I have for present purposes confined that term, is the indication of a state of abnormal nutrition, but that, it being a result thereof, we must seek to remove the constitutional vice before we can hope to successfully treat the local disorder.—Cosmos.

NEUROSES AND SYMPATHETIC FUNCTIONAL AND INFLAMMATORY DISEASES DUE TO DENTAL IRRITATIONS. By Percival E. Loder, M. D., D. D. S., Read before the Pennsylvania Association of Dental Surgeons, June, 1903. Neuroses is a term applied to diseases supposed to be seated in the nervous system, either brain or spinal cord, and which are indicated by disordered sensation and motion, or a disturbance of the mental faculties, without evidence of any change in the structure of the parts—due to some direct irritation to the brain or spinal marrow,

or irritation to the peripheral nerves, thus indirectly causing nervous disease by reflex action.

Here, however, we wish to speak only of neuroses arising from irritation of those filaments of the trifacial nerve that come from the second and third division, and are distributed to the teeth and buccal cavity. The greater part of these nerve affections is due to direct irritation to an exposed pulp or nerves in the roots of teeth not entirely devitalized. The irritation may be due to particles of food decomposing in the cavity caused by decay of the tooth, or may arise from drinking liquids either too warm or too cold, etc.

We often see severe irritation kept up by the retention of a part of a tooth that is entirely devitalized. In this case the filaments supplying the surrounding tissues are irritated. There is no doubt that a carious condition of the teeth, a devitalized pulp, a diseased condition of the soft tissues, or fragments of the deciduous teeth remaining attached to the gums after the permanent teeth are erupted, are a great and constant source of irritation that may produce nervous disease, such as neuralgia of the head and face, and often of more remote parts of the body. The same condition of the teeth may, through the sympathetic nervous system, produce functional disturbances of the eyes and ears, and if the irritation is not removed will lead frequently to very obstinate inflammatory troubles of these organs.

A very interesting case of sympathetic inflammation of the membranes of the brain has been reported by Dr. J. L. Levison in the Quarterly Journal of Dental Science of 1857. In this case death resulted from meningitis, caused by the irritation resulting from a dental exostosis. Reflex nervous affections, as paralysis, especially of the muscles of expression, tetanus, chorea, epilepsy, etc., are also often to be seen. It should not be forgotten that reflex nervous troubles due to caries occur when the teeth are not painful.

It is difficult to understand how different nervous troubles, as hyperesthesia, anesthesia, spasms, paralysis, etc., will arise from apparently the same cause. The mental faculties also are occasionally disturbed by irritation from this source. This is well illustrated in the case of a boy, aged nineteen, who was admitted to the New Hampshire Asylum with acute mania. On investigation it was found that the lad had been in good health a few days previous to admission, but having had a tooth extracted, which was broken dur-

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ing the operation, a small part of the root was left in the jaw. This began suppurating and caused such irritation as to produce mania. After extraction of the fragment of root the patient rapidly recovered. Another case has been reported, that of a young lady, who was likewise suffering from mania due to dental irritation; she also rapidly recovered after removal of the diseased organ.

In case of a diseased condition of a tooth, whether a simple cavity, with or without exposure of the pulp, or one wholly devitalized, there is not much probability of any nervous trouble developing after it is properly treated and filled with some non-irritating material. This, however, is denied by some writers, who claim that any tooth, after being filled, no matter how carefully, will produce nervous disease, but they are certainly in error.

If we study carefully the nervous distribution and connection of the trifacial with some of the other cranial nerves through the sympathetic system, we will be better able to appreciate the sympathetic affections of the eyes and ears so frequently occurring where there are decayed teeth, especially in children. Such cases are frequently very obstinate in yielding to treatment, unless the diseased teeth are either removed or properly treated.

In studying the nervous diseases due to irritation of the branches of the second and third divisions of the trifacial nerve, it will be well to consider them under three divisions: First, altered sensibility, as neuralgia and anesthesia; second, sympathetic functional disturbances, which lead on to organic changes by first producing congestion, which is followed by inflammation, as those of the eyes and ears, etc.; third, those due to reflex action, as epilepsy, chorea, paralysis, etc.

Neuralgia. This is a term applied to a disease of the nervous system that appears to have its seat in the nerve itself, manifesting itself by pain, sharp and darting in character, usually one-sided, and apparently following the course of sensory nerves. The synonyms of neuralgia are tic doloureux and prosopalgia, etc. The causes of neuralgia are many. Like many other diseases of the body, it has a predisposing cause, and in this disease predisposition is a very prominent factor. Anything that has a tendency to depress the system, as anemia, rheumatism, gout, excessive venery, syphilitic and malarial poison, will predispose to neuralgia. Profound mental impressions, if depressing in their nature, will act

as a predisposing cause. The principal exciting cause of neuralgia of the fifth nerve is undoubtedly a diseased condition of the teeth. Professor Gross has stated that the most atrocious attacks of this disease are generally witnessed in branches of the trifacial nerve in consequence of caries of the teeth. Frequently we have neuralgia of the fifth nerve due to a rheumatic affection of the sheath of the nerve, or to inflammation of the nerve or of some of its branches. As branches of this nerve pass through the small bony canals, such as the infraorbital, anterior and posterior dental, there may be pressure on the nerves in these channels, due either to tumefaction of the nerve or to a contraction of the canal, in consequence of periostitis. This pressure will produce great neuralgic pain by interfering with the transmission of the nervous current.

The conditions of the teeth that will act as irritants are many. Acute and chronic inflammation of the pulp, exostosis, or increase of cement at the extremity of the root, thus encroaching upon the entrance of the nerve, are very common causes. Sensitive dentin, where there is but little decay and the pulp is not exposed, chronic inflammation, and thickening of the periosteum covering the roots of a tooth, abnormal position of the teeth, teeth which remain embedded in the jaw, are often the cause of severe neuralgia. The third molars are the most frequent to be embedded. cause of neuralgia is most often overlooked. Crowding of the teeth will occasion nervous trouble, as also will tumors of the jaw by pressing on the dental nerve; foreign bodies in the pulp cavity, as particles of toothpicks, berry seeds, broken broaches, etc., injuries produced by extraction of the teeth, whether successful or not, by injuring the soft tissues, small portions of tooth tissue remaining attached to the gums after extraction, etc., will cause nervous trouble.

It is well known that pain is not always felt at the point of injury or irritation, but is often reflected to distant parts of the body, thus accounting for the neuralgias which are felt in the extremities and in the internal organs. These neuralgias are often cured by the treatment or extraction of a carious tooth. On the other hand we often have toothache when the teeth are perfectly sound, due to some disease in the ears, eyes, or some remote part of the body.

There is evidently great sympathy between the teeth and uterus. Anstie mentions a peculiar case in which uterine neuralgia was immediately relieved by the extraction of a carious tooth. It is very DIGESTS. 1499

common to see toothache in apparently sound teeth during pregnancy. This is probably due to reflection of pain from the uterus. If there is any caries at all the patient is most certain to suffer more or less during gestation. At times there is so much suffering that it is necessary to treat the teeth or remove them during this period. Usually teeth are allowed to take care of themselves during gestation, but this is a mistake. There is no reason for not attending to the teeth at this period, except possibly in some highly nervous women. Even in these cases it would be well to give them some attention. Teeth can be filled and extracted, if necessary, without any evil results following, if it is carefully done. The writer has extracted teeth during every month of gestation without any unpleas-

ant symptoms arising.

For further proof that neuralgia is often the result of caries or irritation to branches of the second and third division of the trifacial, I will give abstracts of a few reported cases which were cured by extraction of decayed or diseased teeth. A case is reported, the subject being a highly nervous woman, who was suffering from neuralgia and deafness due to a third molar which was slightly painful to the touch, complete cure following extraction of the tooth. An account is also given of a severe case of sciatica which would not vield to any medical treatment, but was cured by the removal of a number of decayed teeth. Two cases have been reported by Samuel A. Parker. The first was a case of periodical neuralgia affecting the face, ear, and temple; the root of the tongue was the seat of violent pain, the paroxysms continuing from six to eight hours. periodical pain for a long time resisted all medical treatment. It was completely cured by extraction of the left lower molar, which was found to be decayed to the gum, the surrounding tissues being much inflamed. The second case was that of a young lady who complained of severe neuralgic pain in the temples and inability to sleep. A number of teeth were found decayed and broken off to the gum. but the patient never had toothache or any soreness about the gums. Removal of the stumps cured the neuralgia. A case of severe neuralgia due to a fibrous growth of new formation among the peripheral nerves has been reported, which was cured by extirpation of the nerve. A number of cases of neuralgia following extraction of diseased teeth are on record; these were probably due to injury to the nerve

filament, or to irritation resulting from a small part of the root remaining in the socket.

Gross in his "System of Surgery" makes the following statement: "There is a form of neuralgia of the jaw bone which has its seat in the remnants of the alveolar process of edentulous persons or in the alveolar structure and in the overlying gums. It is met with chiefly or exclusively in old people, and is more common in the upper than in the lower jaw. The parts affected are usually very small, not exceeding a few lines in extent. The soft tissues do not seem to suffer much. The morbid action is generally limited to the bony structure. The symptoms are generally those of ordinary neuralgia. The pathology of this affection seems to be compression of the minute nerves, distributed through the wasted alveolar process, dependent upon encroachment of osseous matter upon the walls of the canals in which they are naturally enclosed, thus interfering with the transmission of the nervous current. The treatment of neuralgia due to this cause would be the removal of the affected part of the alveolar process by cutting through and turning back the soft tissues and removing the alveolar process with a pair of sharp-edged bone forceps."

Pathological Anatomy.—Generally there is no anatomical change, but when change takes place the following condition is most frequently to be noted: Inflammation of the nerve, producing swelling due to inflammatory exudation; and as the tooth structure is hard and unyielding, and there is great pressure on the nerve tissue, pain must necessarily result. The pressure may be from other causes, as exostosis, tumors, or from a thickening of the periosteum lining the small, bony canals in the superior and inferior maxillary bones.

Symptoms.—The usual symptom is that of gradual increase of pain about the face or head. If the pain is due to irritation resulting from decayed teeth it often appears suddenly and with severity. It may be weeks or months before a case of neuralgia is fully developed. Then it will come on periodically. The paroxysms will be at intervals of a few hours to days or weeks. During the intervals there will be no suffering, or if any, a mere sense of soreness. During the paroxysms the patient will experience a most excruciating, sharp pain piercing the face; the muscles of the face become convulsed, the eyes red, and lachrymation increased. Pain will often be reflected to remote parts of the body. There are certain points that are usually

more painful at this time, as where the nerves emerge from the different foramina—the supraorbital, infraorbital, mental, etc.

Duration.—When it can be traced to some local irritation, as caries, and this is removed, the duration of the disease is short; but when a local irritation cannot be found, and the disease is the result of some poison, such as the rheumatic and syphilitic, or is due to some degeneration of nerve structure, the course is usually chronic. If the neuralgia is due to malarial poison, and the proper treatment is instituted, it can be promptly cured.

Treatment.—If the cause can be found and removed this will usually be sufficient; but when the disease is due to toxic agencies in the blood medical treatment must be instituted. If there is evidence of malaria large doses of quinin, ten to twenty grains during the twenty-four hours, must be administered. If a syphilitic history is obtained iodid of potassium and bichlorid of mercury will be called for. If there is much anemia iron must be administered, together with a good, generous diet. Even when the disease is due to some local trouble it will be necessary in many cases to give constitutional treatment, after the local irritation is removed, to completely break up the paroxysms. If the disease proves obstinate good results can often be obtained by giving three or four times daily an antineuralgic pill made after the following formula:

B Quininæ sulph., gr. ii; Morphinæ sulph., gr. 1-20; Strychninæ sulph., gr. 1-15; Acidi arsenosi, gr. 1-15; Ext. aconiti, gr. 1/2. M.

At times the paroxysms of neuralgia are so severe that morphia administered hypodermically (one-quarter to one-third of a grain) will be necessary to give relief. By combining one-fiftieth of a grain of the sulphate of atropia with each dose of morphia we will often get better results than from morphia alone. An external application of warm compresses medicated with laudanum will often give relief. An ointment consisting of forty grains of veratria to the ounce of simple ointment will frequently give good results when applied in small quantity, three or four times a day, over the affected region. Rub in the ointment with the finger until a burning or tingling sensation is produced, after which the parts can be covered with soft flannel. When the neuralgia is due to some organic change in the

course of the nerve, as in neuroma, nothing short of excision of the nerve will do any good. Simply dividing it is not sufficient.

Sympathetic Functional Disturbances, Leading on to Organic Changes.—The connection existing between dental irritation and various affections of the eve and ear was recognized by Richter as far back as 1705. He mentions the case of a lady who was nearly blind for a period of several years, a complete restoration of vision being obtained, after all other treatment failed, by the extraction of a carious tooth which had troubled her for a number of years. Beer in 1817 mentions a case of contracted field which was entirely relieved by the extraction of a carious tooth. Mr. Jonathan Hutchinson (1865) was the first to write a systematic paper on the subject, calling it to the attention of eve surgeons in a paper, entitled "A Group of Cases Illustrating the Occasional Connection between Neuralgia of the Dental Nerves and Amaurosis." In this paper he stated his belief that many cases of contracted vision in infancy are caused by irritation of the fifth nerve consequent upon dentition. Somewhat later Wicker of Berlin confirmed these views and gave a collection of cases. Alexander of Aix-la-Chapelle gives the history of a patient who suffered with amblyopia. Examination with the ophthalmoscope gave negative results and entirely failed to reveal the cause. On questioning closely he found the patient suffered greatly at times from severe toothache. An examination of the teeth revealed a carious upper molar; this being extracted the vision became normal in two days. Schmidt of Berlin wrote an exhaustive article on "The Reaction of the Power of Accommodation, the Result of Toothache." He examined the vision and eve ground of ninety-two patients who were attending the clinic of Professor Albrecht for carious teeth: only nineteen were found to have normal vision, and in some the loss was very marked. The following is a collection of cases seen and reported by a number of professional men, not only dentists, but practitioners of medicine and eye and ear specialists.

In a case reported by Dr. McClure, J. C. H., aged twenty-two, sought advice for failing vision in the left eye. He first noticed impairment of sight five days previously. He could not read with the left eye. Right eye normal. The ophthalmoscopic examination revealed nothing that would account for the loss of vision. On questioning the patient it was found that he had suffered with toothache for some time. The teeth were examined and the left bicuspid,

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which had been filled some time before, was found very sensitive and with a feeling of elongation. The patient was recommended to have the tooth extracted, which advice was complied with. The result was most happy, as the patient returned in a few days with normal vision.

The following case, reported by Dr. M. F. De Witt, is of interest. The patient had always enjoyed the best of health, noticing for the first time his trouble when out on a gunning expedition. When about to take aim he discovered that the eye usually employed was almost entirely blind, barely distinguishing between light and darkness. His eye remained in this condition for nearly twelve years. when he applied for relief. On close questioning it was found that about the time he had first noticed loss of vision he had been having considerable trouble with his teeth, having had several filled, one of which afterwards he was obliged to have extracted on account of tenderness and aching. An examination revealed a carious molar with a fistulous opening in the alveolar process. Extraction was recommended, but the patient objecting, the filling was taken out and the fistulous tract treated in the hope to relieve in this way the condition. The fistulous opening healed over and the vision began to improve, and no doubt would have entirely returned if the patient had not taken cold. This started the fistulous condition afresh, and the tooth also became quite tender. The patient at last consented to have the tooth extracted, after which the vision began to improve and was perfectly normal in the course of a week.

Another case is that of Geo. W., aged thirty. Six months previous to the time of consultation the patient suddenly noticed a dimness of vision, this condition having lasted ever since. The patient had always had good health. Never used tobacco or alcoholic liquors to any extent. The vision being tested, he could make out Jager's test type number seventeen. Ophthalmoscopic examination was entirely negative as to revealing the cause of the trouble. After a week's treatment with remedies usually used in such conditions, but with no apparent improvement, the patient one day casually spoke of having toothache. The teeth were examined and three or four carious ones were discovered. The patient stated that for a long time he had suffered more or less with toothache. Not caring to lose the teeth, the pulps were destroyed and the cavities filled. The result of the treatment was entirely satisfactory; the vision returned to normal.

Fred. —, aged eighteen, who complained that his vision had failed within four days to such an extent that he was no longer able to read, stated that there was "nothing the matter with him but the toothache." The teeth were examined, and on both sides carious molars with exposed pulps were found. Extraction being advised, the teeth were drawn the next day. Within a day after removal of the teeth the vision returned to a normal state.

Mary H., aged eighteen, complained that for the past five days her sight had been gradually failing, until now she was unable to read or write. General health had always been of the best. Eye ground was found normal on ophthalmoscopic examination. After a few days of the usual treatment, with entirely negative results, she one day ventured the remark, "I have been almost crazy with the toothache." The teeth were examined and several badly decayed ones found. She was advised to have them extracted. Returning in three days after the operation, she had recovered perfect vision.

Mr. A. B., aged twenty-one, had been troubled with partial loss of vision in one eye for several months, and for a few weeks before consultation the sight had rapidly failed until he was unable to distinguish objects at twenty feet distance. There had been no pain in the eye. The pupil was much dilated. The teeth being examined, most of the superior ones were discovered in a carious condition. Believing this to be the cause of the loss of vision, several old roots and molar teeth were extracted, two centrals and two laterals were filled with gold in each proximal surface, also two bicuspids in mesial surface. The gums being in a swollen, flabby condition were treated with astringents. The vision began to improve immediately after finishing the above treatment, and steadily progressed until it returned to normal.

There may be dis'urbance of vision where no pathological change in the teeth is present, a simple neuralgia of the dental nerves being sufficient to produce visual disturbance. The following is an interesting case of this kind. Fred. W. K., aged thirty-seven, complained of severe neuralgia of the dental nerves of several days' continuance. Since the neuralgia seizure the vision had become very dim; before the attack it was perfect. On testing the vision large letters only could be seen. Ophthalmoscopic examination revealed nothing abnormal in the eye ground. The teeth on examination proved perfectly sound and in good condition. He was given treat-

ment for the neuralgia, and under it he recovered in a few days. The vision became normal as soon as the pain was relieved.

The opposite condition is illustrated in the following case, reported by Mr. Jonathan Hutchinson. The patient, a young man, was suffering with acute ulceration of the cornea, accompanied with hypopyum chemosis and much pain. He complained that the eye made his teeth and ear ache. The teeth were examined and found in a sound condition. Here is an instance where the pain certainly began in the periphery of a sensory nerve and induced pain in two distinct and somewhat distant parts.

Crowding of the teeth without pathological change may cause loss of vision. The patient, a boy, woke up one morning unable to see objects clearly—practically blind. He was taken to a hospital where a thorough examination was made of the eye ground, but no cause could be found until the mouth was examined and a great crowding of the teeth discovered. Thinking this might be the cause of the blindness, three molars were extracted to give more space for the remaining teeth and to remove the pressure. A marked improvement was shortly noticed, and in the course of a few days the vision had become normal.

Dental irritation is often the cause, or, where already existing, will aggravate an inflammation of the eye. This is not hard to understand, knowing the intimate nerve connection existing between the teeth, eyes, and ears. Where continued irritation of the nerve filaments existed a disturbance of the vasomotor nerves would follow. and a consequent dilatation of the capillaries, which in turn would lead to congestion and inflammation. This is well illustrated by the following cases: Case I.—A lady, aged twenty-five, had circumscribed scleritis of the right eye. The general health was good. No cause could be found for the inflammation until it was discovered that she had a troublesome tooth—the second upper molar of the same side as the affected eye. The general treatment pursued in like cases produced no perceptible good. The tooth was extracted, and the inflammation began to subside as if by magic. Case II.—The patient suffering with the same kind of inflammation (scleritis), with the addition of profuse lachrymation of the affected eye. Her bodily health was excellent. The treatment, as in the previous case, was of little if any benefit. On examination it was discovered that she had a tender aching upper molar of the right side, the same side

as the affected eye. The tooth being extracted the lachrymation ceased, and in a few days the eye was entirely well. Case III.—This was a patient who was treated in the Royal Ophthalmic Hospital, Moorfields, and the case was reported by Mr. Jonathan Hutchinson. The patient, a young man, had almost constantly recurring ulcers of the cornea, with hypopyum, etc., which resisted all treatment. An examination of the mouth was at last made and a number of carious tender teeth were found. After these were extracted the ulcers at once began to improve, and the case went on to complete recovery without any recurrence of the ulceration.

The following is an interesting case of a lady who suffered for ten years with neuralgia of the left eye and side of face. The iris of the affected eye was changed from hazel to dull gray. This condition had resisted all treatment, until she was advised to consult her dentist. He found a carious cuspid and bicuspid of the left side. The extraction of these teeth was followed by a terrible paroxysm of neuralgia. After this had subsided a marked improvement was noticed. There was some pain left, however. A second examination was made, and a tender bicuspid of the right side appeared. This was extracted. Complete recovery followed, and eventually the iris returned to its natural hazel color.

The following case, reported by Dr. Wright of Indiana, is of interest. A lady, aged forty, had an obstinate, round, indurated ulcer on the cornea of the right eye, which had resisted the treatment of several specialists. She was advised as a last resort to see her dentist. His examination discovered a carious upper molar of the right side. This was extracted and an abscess at its root brought to view. The same treatment was now continued which had been adopted before the extraction of the tooth. The eye began to improve at once and was very nearly well in four days. This same treatment had been pursued for months before the removal of the tooth, with no perceptible improvement.

The ear is as liable to disturbances caused by dental irritation as the eye. Children during dentition are subject to severe neuralgic attacks, and during this period they are also very liable to severe inflammation of the middle ear, which in many instances, if not the immediate, is at least a predisposing cause of inflammation, which if allowed to run its course often results in complete destruction of the hearing.

Sexton of New York, who examined the teeth and ears of the inmates of a large charitable institution, they being almost exclusively within the age of second dentition, found that over six per cent were suffering from otitis media purulentia. In thirty children there were frequent attacks of earache; in some cases there occurred earache and toothache at the same time. In many cases where inflammation cannot be directly traced to dental irritation as its cause it is certainly aggravated by the latter, and a cure is seemingly impossible until the dental irritation is removed. Children who are undergoing treatment for otitis media are almost sure to have a recurrence of the discharge and even some renewal of the inflammatory symptoms during the eruption of a tooth. After the irritation caused by the tooth has subsided the treatment will again progress favorably.

The following case shows the necessity of examining the mouths of children subject to aural trouble: The patient, a child, had been suffering for some time with earache. The cause was not apparent until the mouth was thoroughly examined. A fragment of enamel was discovered which had been left behind from one of the deciduous teeth. This was wedged in the gum alongside of a newly erupted molar. The membrana tympani was decidedly inflamed. The removal of the fragment cured the neuralgia and the membrana tym-

pani returned to its natural appearance.

The eruption of the third molar is frequently the cause of grave aural disease. If the ear be already affected with disease when the eruption of the teeth begins this will aggravate the trouble. A case reported by Sexton illustrates this latter condition. Patient, aged twenty-four, had a mild attack of aural inflammation caused by seabathing. The membrana tympani not clearing up, as is customary in such cases, a search was made for its cause. A superficial abscess was found over the left lower third molar. This had been the cause of more or less irritation for a year or more. The tooth was extracted, the gums slowly healed, and the aural symptoms began to improve.

Caries of the teeth may be the cause, directly or indirectly, of severe aural disturbance. The following is an interesting case of this kind: The patient, a lady, had suffered more or less with pain in a superior molar of the right side for three months. The toothache was accompanied with pain of a neuralgic character in the face and right side of the head. One day she noticed that she had become

entirely deaf in the right ear. This condition lasted for four days. She then applied to her dentist in regard to her aching tooth. This was extracted; the neuralgia was relieved, and within an hour the hearing returned to the affected ear.

Serious aural trouble is often caused by direct irritation of the gums or mucous membrane of the mouth. Hilton (in "Rest and Pain") gives a case where the tongue was wounded by a roughened tooth. The gentleman affected suffered greatly from a persistent earache, for which he had received local treatment without relief. Mr. Hilton discovered an ulcer on the side of the tongue, which readily healed when the roughened edge of an adjacent tooth was smoothed off. There was no return of the aural trouble.

The wearing of artificial teeth is undoubtedly often the cause of aural disturbance. Not only when they are ill-fitting, but when for any cause the substance of which they are made is irritating to the mucous membrane of the mouth, or when the suction necessary to keep the teeth in position causes irritation and thickening of the mucous membrane. The following case, that of a physician, illustrates the trouble a poorly fitting plate may cause. For six years the doctor had worn a gold plate which supported two upper incisors. He always thought the plate satisfactory. The breath becoming foul, he applied to a dentist to have the tartar removed. It was suspected only on lower teeth. The dentist, who was also a physician, thought it well to examine the whole mouth, when to the patient's surprise it was found that the gum was partially detached from the lingual surface of all the superior teeth. The foul breath was now evidently to be attributed to the ulcerous condition of the gums. The patient then recalled that for more than a year he had been troubled with tinnitus aurium and deafness. This condition was due to a badly fitting plate, which pressed against the teeth where the gum was attached, and its constant pressure and movement kept the gums in a hyperemic state.

Dr. Sexton, in fifteen hundred recorded cases of aural disease, found that one-third owed their origin or continuance to diseased teeth. As regards the diseases of the teeth which cause this nervous irritation, nearly all their affections appear capable of producing these conditions. Thus caries, with or without exposed pulp, exostosis, hypertrophy of crusta petrosa, nodular developments of dentin in the pulp cavity, periostitis (plastic or suppurative), crowding of

the teeth, etc., are among the causes which produce these conditions. As an irritated catarrhal state of the mucous membrane of the mouth is a cause of aural disturbance, anything which would cause hyperemia would be liable to produce these affections. Roughened teeth which scratch the tongue or wound the cheek, deposits of tartar—all these conditions should be carefully looked for in obstinate eye and ear cases. The recognition and removal of these apparently slight causes are often among the cases where the most brilliant cures are effected, to say nothing of the distress which their recognition relieves.

Since the above has been written I have received the following notes of a case of deafness from Dr. D. N. Dennis of Erie, Pa.: Rosa —, aged fifteen years, complained of severe pain in the left ear and side of face, accompanied with almost complete deafness. These symptoms would last for several days and then subside. She said that when her tooth ached the pain and deafness began to trouble her. Thinking the cause of the aural trouble might be a carious tooth, the mouth was examined. A carious upper molar of the right side was found with the pulp exposed and very sensitive. Extraction was recommended. After the tooth was removed the pain and deafness entirely disappeared.

Since writing this paper my attention has been called to a paper read by Dr. Kate W. Baldwin of Philadelphia before the American Medical Association, in the Section on Laryngology and Otology, entitled "The Teeth as a Cause of Pathologic Conditions in the Throat, Nose, and Ear," in which she reports the following: Case I.—Twenty-two years old. Both ears had been aching for four days, toothache several weeks. Gums hard and greatly congested over third molars, other teeth in fine condition, gums were freely lanced. a cathartic given. The patient slept quietly all night and had no more trouble. Case II.-Patient four years in getting the four third molars. During this time had no toothache, but frequent attacks of earache, which were always immediately relieved by a free incision of the gums. Case III.—The eruption of the third molars extended over six years. About every three months patient had earache, no pain in teeth, earache always relieved by lancing the gums. Earache from impacted third molars, more frequently caused by the upper ones. Case IV.—Patient twenty-two years old. Had facial neuralgia and earache, not relieved by general treatment, referred to

dentist. Roots of left superior first molar in position (the tooth was extracted six years previous), inferior second molar pulp exposed. Roots were extracted, second molar treated and filled. Two weeks later patient reported having been perfectly free from both neuralgia and earache. Case V .- Patient thirty-three years old. Had had frequent earaches for one year, severe for two days, had prevented sleep. Left external auditory canal and membrana tympani much congested, teeth in good condition, except lower second molar, which had no cavity, but a white, chalky appearance. As it gave no trouble the patient refused to go to a dentist. Coal-tar products controlled the pain, atropin and a laxative for three days relieved the other symptoms; eleven days later patient returned with practically the same symptoms, which were relieved in four days; twenty days later returned with earache, and the tooth had been growling. She had the tooth extracted and the ear caused no further annoyance. Case VI.—Boy twelve years old. For three weeks the left ear and all the upper teeth on that side had been aching, six months previous he had fractured the left central incisor, all the other teeth in good condition. The fractured one was abscessed, the pulp was a putrescent mass. The tooth was treated and all the symptoms relieved. Case VII.—Patient complained of deafness and tinnitus and some pain in the ears and that the teeth were in a horrible condition. Teeth were so had that the patient was referred to the dentist at once, sixteen teeth were extracted and the others treated. Three weeks later reported being all right. Case VIII.—Child seven years old. Left ear had been aching for two weeks, no throat or nose trouble of any The left membrana tympani much congested, one point almost bleeding, teeth in very bad condition, deciduous molars blocking well advanced bicuspids, first molars gone to pulp. Teeth were extracted and the ear symptoms quickly cleared up, no pain after extraction. Case IX.—Child one and one-half years old. Had had pain around left ear for two weeks with some swelling. There was tenderness over the mastoid and congestion of a small hematoma on the posterior wall just in front of the drum, upper and lower molars well advanced, gums greatly congested. The gums were freely lanced and the patient was to return the next day if not better; returned in three days and required no further treatment.—Brief.

PORCELAIN CORNERS RETAINED BY PORCELAIN PINS. By John M. Byers, D.D.S., Brooklyn. Read before the Second District Dental Society, March, 1903. Probably in no other position in the mouth do the esthetic qualities of porcelain fillings appear to such advantage as when used to restore the contour of an incisor, and in no other class of porcelain fillings do we meet with more difficulties of retention. The shallow depth to which the matrix can be forced limits the distance to which we can carry our porcelain body. So in proportion to the depth do we have weakness or strength. Therefore, it is good reasoning to assume that if we can get a deep, solid mass of procelain in the form of a pin or block within the tooth—this pin to be part of the filling and homogeneous with it-we will have a filling that will hold and withstand more than the ordinary stress of mastication—provided it is perfectly made and properly articulated. Let me add that no such filling should ever be allowed to come in actual contact with the occluding tooth.

I think you will agree with me that a solid porcelain pin, of sufficient thickness, has greater strength than any platinum pin or bar that can be baked in. With this idea in mind let us proceed to make a corner filling—with a big, thick porcelain pin—that will hold it in place against all the heavy strain to which its exposed position subjects it. We will assume that an upper central incisor presents with a broken corner involving one-quarter or more of its labial face. Having obtained a good separation, apply the rubber dam to at least three teeth, obtaining plenty of room to work the matrix. I am aware that some operators do not think it necessary to use rubber dam for porcelain work; but the saving of time, inasmuch as you are not obliged to continually dry the cavity, will alone be reason enough, to say nothing of the fact that cement must have considerable time to dry before exposure to the saliva.

Cavity Preparation. First take a medium garnet-paper disk, and cut the edges down until they are flat and true, making a sharp angle with the labial and lingual faces of the enamel. All bevel edges must be sacredly avoided; a flat, even surface is the very foundation of our filling. We will now deepen the interior cavity; take a new bur and cut into the dentin, being careful not to overheat the tooth, and carry the excavation to its greatest possible depth. Cut on perfectly true, straight lines, so that the cavity when completed may present without the faintest suspicion of an undercut. If

you will be careful not to overheat by the rapidly revolving bur, and apply a drop of pure carbolic occasionally, you can deepen the cavity to a surprising degree. Always use a new sharp bur.

The Matrix. We will now take a small sheet of platinum and burnish it into the cavity in the usual way. We find that the platinum can be carried in a short distance only, when we come to a point where if we burnished any further we would puncture the matrix. Do not go any deeper, but otherwise complete the matrix, carrying it well over the edges, and be sure there is no rocking. Return now to the interior. We have forced the platinum foil as far as it will go; take a ball burnisher and push it right through the foil into the cavity beneath. Break right in and dress the foil up against the cavity walls. This is the primary matrix. Being satisfied that the adaptation is perfect, carefully remove and lay it aside, and take up the construction of the secondary matrix. Cut an orangewood stick to fit the cavity as perfectly as possible, smoothing it with a fine disk, and if made with care it will serve as an excellent model upon which to mold the secondary matrix. Fold the platinum about the end of the wooden model, turning in the ends, very much as you would do up a paper package. Loosen this platinum cap and carry it to place in the cavity; it will be found to fit fairly well, and the burnisher will complete the adaptation. Allow a slight overlapping at the opening.

Fusing the Porcelain Pin. Being properly adapted, remove, fill with porcelain body and bake. Fuse a very small portion of body at the bottom first, and gradually build it up, stopping a little short of the opening. When this baking is complete we have what in the finished filling will be the pin. The primary matrix must now be replaced, then take the secondary, containing the porcelain pin, and carry it into place, forcing it through the primary until it fits properly. Burnish the narrow edges of the secondary matrix down to act as a flange.

Both may now be removed together, using special care, and proceed to build up the contour and bake in the usual way. When completed and the platinum stripped off you will have a porcelain corner, reinforced by a strong serviceable pin, and it should fill the cavity so perfectly that only the thinnest cement can be used for the setting. For this class of filling I use platinum for my matrix, with the Jenkins' body. The first button on a Hammond furnace will

give all the heat necessary for fusing. It may be of some assistance to invest the secondary matrix, although it can be handled without. However, after the filling is well under way I prefer to work without investment, so that the piece may from time to time be put into position in the cavity, to inspect the edges and verify the contour. These fillings can be made quickly, but we should give to each case all the thought and time necessary, and thereby give better service to our patients, and enhance our reputations as operators.—Items.

REQUIREMENTS FOR PERFECTING AMALGAM FILL-INGS. By Dr. W. E. Harper, Chicago. Read before the Colorado State Dental Association, June, 1903. It has been estimated by reliable authorities that amalgam is used for filling at least four-fifths of the cavities prepared in teeth; equally good authorities agree that the average life of amalgam fillings is from three to five years. These statements I regard as approximately true, and it is my conviction that we are not justified in so general a use of this material unless more permanent results can be attained, and these I am convinced are possible with proper cavity preparation, instruments, and instrumentation, and the use of one of the high grade alloys such as may be purchased from any reliable dental supply house. In the proper use of a high grade, quick-setting alloy we eliminate the chief causes of failure possessed by the slow-setting silver-tin alloys, so generally used until the results of the investigations of amalgam made by Dr. G. V. Black were published in the Cosmos of 1895 and 1806.

Objectionable Characteristics of Amalgam. As a result of these investigations the following causes of failure were demonstrated as common to the alloys used up to that date, copper amalgam being practically the only known exception: First, excessive shrinkage, impossible to avoid in alloys containing less than sixty-five parts of silver to thirty-five parts of tin, this shrinkage increasing with the age of the alloy, unless fully annealed by heat, in which case we would have the maximum shrinkage. Second, flow; the disposition of these amalgams to flow or crawl from under intermittent or continuous pressure, such as fillings are exposed to in biting and mastication; this flow would show by the filling curling from the walls or margins of the cavity, and has been interpreted as "spheroiding."

These two objectionable features, impossible to eliminate from the slow-setting silver-tin alloys by any practical method of manipulation, instrumentation, or cavity preparation, were common causes of failure which have been remedied in the modern high grade alloys, as may be best appreciated by comparison of the following tests, made with annealed alloys, one point representing a fluctuation of I-IO,000 of an inch:

	Formula.	Points of Shrinkage.	Points of Expansion	Flow under 60 lbs. pressure for one hour.	Crushing stress lbs.	Remarks.
	55 Silver 45 Tin	} 11	1	29%	222	A popular formula of a slow-setting soft alloy.
	5 Silver 5 Tin	} 18	0	18%	276	Most popular formula of the slow-setting soft alloys as used in the past.
. 2	58 Silver 66 Tin 5 Copper 1 Zinc	0	Ö	1%	400	Approxima t e formula of most h i g h grade, q u i c k-setting hard alloys as sold by reliable dealers.

Of the three formulas exhibited, two are of the old slow-setting soft type, each of which shrinks badly, and under a continuous pressure of sixty pounds for one hour flows 18 per cent to 29 per cent, their diameter being reduced by the amalgam spreading laterally, and, if in a cavity, would appear as curling from the margins, leaving a perceptible gap. The crushing stress of this class of amalgams ranges from 200 to 276 pounds, being broken into fragments when exposed to this weight.

With the hard, quick-setting, high-grade alloys, we find the shrinkage and expansion eliminated, the flow reduced to one per cent and the crushing stress, or weight required to break the filling, increased from 276 to 400 pounds. With these improvements in the qualities of alloys used at the present time we should be able to secure much more permanent results in our amalgam operations, if

we give the requirements of each case the same consideration which is admitted to be necessary for a gold filling, viz.: correct cavity preparation; separation to restore the interproximate space and the normal contact, with smooth polishing of the filling; and proper mixing and packing of the amalgam, using suitable instruments.

Deductions from Test Fillings. The importance of the proper kind of instruments for packing the amalgam cannot be appreciated until one undertakes to make test fillings for microscopic examination, and for testing flow and crushing stress. These test fillings are made under conditions much more favorable than those we work under in the mouth, in spite of which the microscope will plainly show many imperfections in adaptation around the margins, and it requires much experience, care, and skill to eliminate these imperfections.

The results of tests for flow and crushing stress show the marked influence of different methods of packing on the strength of the hardened filling. The following may illustrate and prove of interest in this direction, being the results of tests made by Dr. Wedelstaedt of St. Paul. Test fillings four millimeters square were made, using the same alloy with the same proportions of mercury and alloy for each mix, and worked under conditions as nearly as possible the same for each. After mixing, the mass was divided into a number of equal parts and each piece when placed in the cavity was given the same condensation or packing as indicated in the table.

	of Blows	Weight of blows.	Serrated plugger Diameter of point.	Average stress required to crush the filling.
	45	2-lbs. II ozs.	1 millimeter	83 lbs.
	30	2 lbs. 11 ozs.	I millimeter	103 lbs.
	15	2 lbs. 11 ozs.	1 millimeter	360 lbs.
	45	13 ozs.	1 millimeter	473 lbs.
	.30	13 ozs.	1 millimeter	653 lbs.
	15	13 ozs.	1 millimeter	665 lbs.
	15	13 ozs.	3 millimeters	633 lbs.
	15	2 lbs. 11 ozs.	3 millimeters	900 lbs.
Heav	y hand p	oressure	3 millimeters	900 lbs.

Outline of Cavity Margins. Cavity preparation in every detail should be the same as for gold. On occlusal surfaces angular or imperfect grooves should be cut out to a point where a perfectly smooth finish of the filling and tooth surface may be made, and all

caries uncovered, leaving enamel rods supported by dentin. In approximal cavities the buccal and lingual margins should be cut sufficiently wide to permit the excursion of food in mastication to constantly cleanse their full length. The gingival or cervical margins should be located just beneath the free margin of the gum except in those cases of excessive recession of the gum, where this margin may be cut to a wide portion of the interproximate space.

Seat or Floor. The seat or floor should be flat and cut at right angles to the long axis of the tooth, and should be equal in area to the surface of the filling exposed to mastication, to most effectually resist the crushing stress and flow of the amalgam and to afford the greatest security against movement in the cavity and displacement under a heavy bite. By means of the gnatho-dynamometer we find most people can close their teeth with a force of at least one hundred pounds, and in many instances two to three hundred pounds. The floor or seat is best cut flat with the flat end of an inverted cone or fissure bur held parallel with the long axis of the tooth. By this means we make definite angles in the dentin at the junction of the floor and surrounding walls, adding much to the retention form of the cavity, which enables us to avoid deep undercuts, which are a source of weakness.

Retention Form. In occlusal cavities, prepared with the inverted cone or fissure bur as described, the angles of the floor and surrounding wall would be definite and the walls practically parallel to each other. This will afford all necessary retention and the same general preparation may be given to simple buccal and lingual cavities. In approximal cavities of the bicuspids and molars it is necessary to cut a step on the occlusal surface, the floor of which must be flat, as it constitutes a portion of the seat, and only slightly dovetailed, because many failures occur as a result of making a narrow neck, the filling breaking at this point.

Matrix. All cavities for amalgam must have surrounding walls to resist the necessary pressure in packing the amalgam. If one or more of the walls are missing the matrix must be applied, and it is important that it be closely adapted to all margins and be tied or held in such manner as to make a solid, unyielding wall. This procedure is essential to perfect adaptation to margins, the vulnerable point in fillings, and will save much time in the final finishing of the filling.

Instruments. To most effectually compress a semi-plastic mass of amalgam it must be held under the plugger; for this purpose the face is made flat and serrated, and to permit most effectual compression same is made in two forms, round and oblong, and in sizes such as will fill the opening of the average cavities. In selecting a plugger we should choose one that will about fill the cavity; in so doing the plastic mass is confined in every direction by the walls of the cavity and the serrated face of the plugger, and with one forcible thrust of the plugger the mass is given the maximum condensation and adaptation to walls. With this method of procedure we avoid chopping the mass, the effects of which are so well shown in the results of the tests before mentioned, in which we find that a filling four millimeters square, made with forty-five blows on each piece inserted into the cavity with a round plugger one millimeter in diameter, crushed at eighty-three pounds; while the same sized filling, made with one thrust on each piece inserted, with a plugger three millimeters in diameter, required a weight of nine hundred pounds to crush it. The effect on adaptation of using a plugger that is much smaller than the opening of the cavity can be appreciated only by making an experimental test under the microscope, in which the amalgam will be seen to move on one side when packed with a small plugger on the other side of the filling, if reasonable force is

In using steel pluggers that approximately fit the cavity much care must be exercised to keep the point from contact with the enamel walls, as injury will result and possible failure of the filling. To eliminate this danger I have designed an amalgam plugger-handle which carries vulcanized points of various forms and sizes; the faces of these points are rough enough to prevent the amalgam from creeping when compressed, without serrations; these points are interchangeable and will not injure the enamel walls if brought into contact when packing the amalgam.

I also present for your examination an amalgam trimmer having a flexible blade which can be rotated to any desired angle, enabling the operator to reach any part of the margins of any approximal cayity, mesial or distal, with equal facility. This instrument, I believe, will be found indispensable to the careful amalgam worker for trimming fillings to form after the removal of the matrix.

· Qualities of a Good Alloy. The qualities of a good alloy such as

may be purchased from reliable dealers are as follows: It should be non-shrinking. Its expansion should not exceed I-I0,000 of an inch. It should not flow. The crushing stress should exceed 300 pounds. It should make a smooth, plastic mass which will very perceptibly harden when compressed. It should be capable of taking a smooth finish. In naming these qualities, I wish it understood that I am not speaking of a perfect filling material, but simply the qualities as found in alloys within every one's reach.

Proportion of Alloy and Mercury. The proportion of alloy and mercury is important. Insufficiency or excess will result in a weak and poor filling. The proper proportion should be decided by making an experimental mix. Sufficient mercury should be used to make a smooth, plastic mass, and, for immediate insertion into the cavity, should be as stiff as possible, consistent with taking the markings of the skin when pressed with the finger in the palm of the hand. When the proportion of mercury is understood it is best to weigh into separate capsules the alloy and mercury in such quantities as may be found desirable to meet average cavities: this part of the operation may be done at the leisure of the operator or assistant, keeping a small stock on hand. It will be found economical in time and material, and will give exact results. I would suggest that you keep on hand capsules containing ten and sixteen grains, with separate capsules containing the proper quantity of mercury for each; one of either may be used for a small filling or we may take two of them for the larger cavities. By this means the operator will early learn to estimate the quantity required to fill any cavity without waste.

Making the Filling. Before mixing the amalgam the cavity should be examined and made ready for the immediate insertion of the filling, the necessary instruments selected and placed convenient for use. We now take the required quantities of alloy and mercury and place in a deep glass or Wedgwood mortar, and with pestle rub lightly and quickly until the mercury engages all of the alloy; now turn the mass into the palm of the hand and knead very thoroughly until smoothly plastic. If any sloppiness appears, pinch out between the thumb and finger any excess mercury and again knead to proper consistency for insertion—as stiff as possible consistent with taking the skin-marking when pressed with the finger. Now divide the mass and take a piece sufficient to cover well the floor of the cavity,

and with a plugger as large as the cavity will permit pack each piece once or twice with all the force or pressure the operator can exert or conditions will permit. For the angles and irregular portions of the eavity take a small plugger, packing with light pressure to avoid chopping the mass. With this procedure we will secure the strongest filling and the most perfect adaptation. The cavity should be filled with a slight excess, after which cover the entire filling with the end of the thumb and compress as forcibly as possible. This will remove any excess of mercury developed in the packing, and if maintained a few seconds the filling will set hard enough to remain in adaptation with all margins. The filling should now remain undisturbed two to four minutes to avoid the danger of injury in trimming away the excess.

Trimming to Form. This is best accomplished with a large discoid excavator on occlusal surfaces, cutting a little at a time toward or along the length of the margins, followed with very light burnishing. In approximal cavities if a separator has been used we may now loosen enough to free the buccal and lingual end of the matrix and then again tighten the separator to permit removal of the matrix without injury to the occlusal portion of the filling. If the separator is not used the matrix is best removed by drawing it buccally; if drawn occlusally the occlusal portion of the partially hardened filling will often be broken. With the matrix removed we now search for overlaps of the filling, and with the amalgam trimmer same are removed and the filling trimmed to shape. If this is well done the final polishing will require very little time and should be done at a second sitting.—Items.

OPENING INTO THE ANTRUM OF HIGHMORE THROUGH THE INCISIVE FOSSA. By James Graham Sharp, M.D., D.D.S., San Francisco. In the treatment of persistent disorders of the antrum it often becomes necessary to resort to measures more radical than are ordinarily employed. I speak of cases in which the cavity membrane itself is affected, where there is necrosis of its walls, where there are foreign growths or bodies; of cases where it becomes necessary not only to drain the cavity, but where a removal of the irritating growth or substance must be accomplished. Under this head I do not take into consideration those simpler cases of accumulations due possibly to a closure of the outlet

into the nasal cavity, from acute disorders of its membranes, and in which the cavity is not necessarily infected, but simply filled with the pent-up secretions which have undergone some degeneration and which will very rapidly respond to drainage through a small opening into the nasal or oral cavities and liberal irrigation with non-irritating antiseptic washes.

In the more serious complications of the antrum above mentioned, where it becomes necessary to open into that cavity for the purpose of curetting and subsequent treatment, I prefer going through the incisive fossa for several reasons: First-The opening can be made sufficiently large to admit of free exploration of the entire inner surface of the cavity with the finger, and also give a clear view of its walls with the assistance of the lamp and reflected light. Secondly-The opening can be extended sufficiently low to give perfect drainage to the entire floor of the cavity after destruction of its numerous septa so often present. Thirdly—The cavity can be thoroughly packed with dressings. Fourthly-The opening being above the duplicature of the gingiyo-buccal mucous membrane, it will readily close when desired, the cheek replacing the lost wall. Fifthly—The oral cavity, in my opinion, can be more thoroughly sterilized and kept so than the nasal cavity, because stronger antiseptics can be used; it is more under the control of the patient, and ordinarily it is closed, thus more thoroughly preventing infection from the outer air during process of respiration.

Referring to the case operated upon before the California State Dental Association at its last meeting, which may serve to demonstrate the adequacy of this operation, I herewith briefly outline its history before the operation. During or immediately following an attack of coryza the antral symptoms began, at the same time the patient suffered slight pain on pressure from the first molar, which was badly decayed and devitalized; this tooth was extracted, followed by a slight amount of pus, but no opening into the antrum from this location could be detected and no relief was given to the antral symptoms. Two or three days following the extraction an opening was made through the inner wall of the antrum from the inferior meatus; there was some discharge of a cystic character; this continued for about a week in small quantities, as in the beginning not changing in character. At this time I received the case for operation. After dissecting away the soft tissues in the incisive

fossa the bone was chiseled away, making an opening large enough to admit the little finger. The cavity was found to be filled with a broken-down, odorless, semi-solid mass, and on exploring before curetting I could not discover the opening into the nasal passages, neither could I discover a separate cystic membrane. The walls were lightly curetted with a sharp instrument, swabbed with pure creosote on a bit of gauze, with excess squeezed out, tightly packed with iodoform gauze for forty-eight hours, after which the dressing was removed and the cavity flushed daily with boric acid solution and loosely packed with boric acid gauze. At the end of three weeks the wound had completely closed, with the exception of a slit in the soft tissues at the duplication of the gingivo-buccal membrane, which was kept open for another week, no discharge being present, for purposes of examination, when it was allowed to close. Two months have elapsed and no return of trouble has been manifest. I will add that after curetting I forced an opening through the wall into the middle meatus and drilled the edge away, making it sufficiently large to remain open.-Gazette.

A GENERAL KNOWLEDGE OF DRUGS AND MEDI-CINES ESSENTIAL TO SUCCESSFUL DENTAL PRAC-TICE. By J. P. Buckley, Ph.G., D.D.S., Chicago. In attempting a discussion upon this subject, I fully realize the possibility of differing from the opinions of some dental practitioners; yet I approach the subject with no apology. The day of empirical therapy is being gradually but surely relegated to the past, and we find rational therapeutics taking its place in dentistry as well as in medicine. To-day we should not be satisfied to know that oil of cloves quiets an inflamed pulp, eucalyptol disinfects a putrescent canal, oil of cassia discolors the tooth structure, etc.; but we should be desirous of knowing why these results are produced, or of ascertaining the constituents of these drugs that give them the desirable or undesirable properties. In fact, we should find the modern dentist showing the same interest in and investigating spirit for this particular field of work that characterizes him in other phases of dentistry. But is this usually the condition existing? How often do we hear men, who seemingly are progressive dentists, taking pride in saving that it is necessary to know only a few drugs-very few-in order to practice dentistry. They boast of the fact that in their

medicine-cabinet you can find only such drugs as carbolic acid, alcohol, oil of cloves, arsenic, iodin, and a few others, and that they never have occasion or feel duty bound to administer an internal drug.

Prescribing Medicines. Now, in this connection it may be advisable, before dipping deeper into this subject, to stop long enough to ascertain the status of the dentist with reference to the internal administration of drugs and medicine for the purpose of allaying pain, or correcting some derangement of an organ which directly or indirectly affects that area of the body over which we are supposed to be the watchful guardians. It is argued by some that the degree of D. D. S, is not broad enough to permit its possessor to prescribe or administer general remedies. In answer to this. I would solicit an examination of the curricula of the schools authorized and empowered by the different state legislatures to confer this degree. It will there be found that the students of most of these institutions are grounded in the sciences of chemistry, anatomy, physiology, materia medica, bacteriology, pathology, and in fact all of the fundamental subjects, and most schools have now added physical diagnosis to their courses. Besides the didactic instruction, a thorough laboratory course is given in connection with most of the subjects mentioned, and in the dissecting-room the students are required to dissect a lateral half of the entire body. Who then, let me ask, is better qualified to treat patients coming to them, even should internal medicines be indicated, than the Doctor of Dental Surgery, who has studied the entire system and made a special study of the mouth and its adjacent parts?

What a Dentist's Knowledge of Drugs Should Be. Believing, then, you will agree with me that a dentist not only has the legal right to prescribe internal medicine, but that it is his duty to do so when the case presents, let us consider briefly what a dentist's knowledge of drugs and medicine should be, and a few dental conditions where internal drugs are indicated. First, a dentist should be thoroughly conversant with all drugs—physically, chemically, pharmaceutically and therapeutically considered. By this I mean that a dentist's knowledge of drugs should be broad enough to enable him, if necessary, to intelligently prescribe general remedies. It appears to me that a dentist does not comprehend his full duty unless he feels competent to meet all cases which are

presented to him; and it is often impossible to mitigate or allay pain coming from a tooth or adjacent tissue, unless internal drugs be administered.

Second in importance to a thorough understanding of drugs and medicine is a knowledge of prescription-writing. Every dentist should be intimately acquainted with the customary method of prescribing medicine. It would seem unnecessary to urge upon my readers the importance of always writing a prescription, and that correctly, when patients are sent to pharmacies for medicine; but an examination of the files of druggists and a few years of personal experience behind the prescription-case are sufficient evidence to convince me that the average dentist is extremely negligent in this regard. It is not my object to discuss prescription-writing in this paper, but the above fact is too flagrantly conspicuous to be unnoticed.

Conditions Where Internal Drugs are Indicated. We will now consider a few pathological conditions often confronting the dentist where internal drugs are indicated. Take, for instance, a putrescent pulp where some of the infectious material has been forced through the apex of the root by virtue of the gases generated in the decomposition, by instrumentation or otherwise, and an abscess is developing, characterized by that dull, dead, gnawing, grinding pain which is produced by the pus trying to bore through the alveolus. With this condition the dentist knows or should know that counterirritation gives but slight or temporary relief. In such instances as this we do not deserve the confidence placed in us by our patients, if we dismiss them without prescribing a general hypnotic, even if morphin must be given to control the pain. However, a prescription should never be written for morphin, as the patient, being satisfied with the effect produced, could get the prescription refilled on the least provocation, and might innocently acquire the habit. But in this case morphin could be given and the patient not know what drug had been taken. Now I wish to be understood as not advocating the injudicious, indiscriminate, or miscellaneous use of such drugs as morphin; but I do desire to say that where the drug is indicated it should be administered; and it seems to me that there is no condition where the effect of morphin is more beneficial, if judiciously used, than in the case to which I have called attention. There are other drugs that can be given with marked benefit, such as

codein (a milder alkaloid of opium), and many of the coal-tar preparations are valuable, among which I might mention phenacetin, acetanilid, etc. But opium, especially its chief alkaloid, morphin, is the one drug, par excellence, to stop pain, as it acts upon and controls the central nervous system. Alterative drugs are also indicated here. The best and most easily administered is potassium iodid, prescribed with some of the elixirs, syrups, or waters to mask the taste.

Another condition demanding internal drugs is that of facial neuralgia, especially where we are unable to at once locate and remove the cause. How often do we find the facial or seventh cranial nerve expressing untold agony as the result of some disturbance of the trigeminus or fifth; and do our best, we are unable at the time to locate the cause of the disturbance. Now, what shall we do in this case? Who wants to admit that he is unable to give relief? Shall we acknowledge our ignorance of a subject that we are supposed to know and turn the patient over to the physician. when the disturbance is purely dental, and let the physician do what every dentist should have done-administer a drug internally to control the pain until the cause can be located and removed? No, let pathological conditions of dental origin be treated by dental surgeons; and if the latter feel unable to treat these cases, then they should study their materia medica. I admit that we are sadly in need of good modern text-books on dental materia medica, but such a textbook would be more helpful to the dental student than the dental practitioner. All general text-books on this subject are for dentists as well as for other specialists of medicine. The drugs indicated here are the hypnotics. Again I must say that there is no drug that will serve us better than morphin, if intelligently administered, in these severe neuralgic conditions where we are unable to locate the cause and must control the pain.

Controlling Nervous Patients. Still another instance where internal drugs can be administered to the advantage of both patient and operator is when attempting to operate upon nervous individuals. It is often impossible to do satisfactory and permanent work for this class of patients unless some drug be administered, previous to operating, that will control the nervous system. I know of no class of drugs that will produce more gratifying results, when the nervousness is mental and caused by worry or dread, than the bromids.

Potassium bromid, being the representative, can be prescribed in the elixirs, syrups or waters which dilute the drug and mask its taste.

Painless Operations Demanded. The ever-alert and suspecting public is making a serious demand on our profession to-day for "painless dentistry." By this I mean that dental operations are expected to be practically painless. There is no drug that will aid us more in meeting this demand than cocain, if properly used. There are but few dentists to-day who do not employ this drug for various purposes. By its judicious use bands can be fitted and crowns and bridges set absolutely without pain; live pulps can be extirpated, fillings inserted, and teeth extracted with no pain, except perhaps the dread of having these operations performed, which is occasioned by past experience and which almost amounts to pain. Now, valuable as this drug is in its local application, no dentist is justified in using it without a thorough knowledge of its toxic action; and in order to combat its toxic effects, which produce alarming symptoms and an occasional fatality, we must be thoroughly familiar with the drugs 'that physiologically antagonize this action. This means the internal administration of such drugs as caffein citrate, strychnin sulphate, atropin sulphate and digitalis; for there is no drug that will physiologically antagonize the toxic effects of cocain.

Many other instances could be cited in substantiating the fact that a general knowledge of drugs and medicine is essential to successful dental practice.

In closing this paper, permit me to enter a protest against the overflowing of our profession to-day with literature heralding the remarkable properties of some *new* drug or preparation. I had better say some *old* drug changed slightly chemically, and given a new chemical formula which in many instances only symbolizes the ignorance of the advertiser and insults the intelligence of the dental practitioner. It is also to be regretted that we are forced to realize the eagerness with which some members of our profession lend their names in testifying to the remarkable properties of these chemicals and preparations, and which when tested in actual practice give a negative result. I do not wish to be understood as discrediting all these new drugs. Some are valuable and placed on the market on their merits by responsible and legitimate firms; but this cannot be truthfully said of the vast majority. I do not object to the use of proprietary medicines, the value of which has been established and

the formulas published; but a dental practitioner has no excuse for prescribing or using proprietary medicine the constituents of which he does not or cannot know without resorting to chemical analysis. Especially is this true of preparations intended for hypodermic or internal administration. Our knowledge of drugs and medicine should be sufficiently broad to enable us to write an intelligent prescription for our own combinations, whether it be for a mouth-wash, a local anesthetic, or for internal administration.—Summary.

SELF-HEALING CAPACITY OF THE HUMAN DENTAL PULP. By W. D. Miller, M.D., D.D.S., Berlin. It is a fact pretty generally known that in the case of certain animals the dental pulp may undergo reparative processes similar to those which take place in other soft tissues. These reparative processes are frequently observed in teeth having large pulps which are open at the base instead of being everywhere surrounded by narrow unyielding walls, as is the case in human teeth. It is particularly the pulp of the elephant's tusk which furnishes us the most frequent examples of self-repair, and at any ivory-turner's we may find numbers of specimens illustrating this fact. The question is discussed at length in a series of articles entitled "Studies on the Anatomy and Pathology of the Tusks of the Elephant," beginning in the May number of the Cosmos for 1890.

It would not be admissible, however, to conclude that the pulp of the human tooth must possess the same reparative powers as does that of the elephant. It is, in the first place, devoid of lymphatics, which everywhere else perform a very important part in taking up and removing pathological products; but especially it is so small that, being surrounded by unyielding walls, the minutest inflammatory focus must result in intense pressure and stagnation, with a marked tendency to breaking down of the tissue or extending of the inflammation, unless the pressure is relieved by a free exposure. It is for this reason that an abscess or center of inflammation the size of a pin-head in the pulp of a human tooth may cause excruciating pain, while its presence on the surface of the body might escape notice altogether.

We may accordingly examine hundreds of extracted teeth without coming across a single case of self-repair such as is so commonly met with in ivory. Indeed, it has been very much doubted

whether a suppurating pulp could or did ever of itself return to a healthy condition again, and, so far as I am aware, the first case of this kind was described by Gysi. In this case an abscess in the horn of the pulp of an upper first molar had undergone an isolating process, the pulp shutting it off by throwing up a wall of irregular dentin followed by normal dentin. A second case, in which an abscess cavity having the greatest similarity to those found in ivory had been isolated or encysted, was reported by me in the *Cosmos*, 1901. In these cases the pulp has protected itself by throwing up a wall of calcific matter (followed by regular dentin), thus shutting off or encysting the offending part.

Since then two other cases have come under my notice. Both these teeth were found among a collection of teeth of unknown history. In the first case an upper bicuspid has been attacked by caries on the abbroximal surface and the buccal horn encroached upon. The pulp succeeded in throwing up a sufficient amount of calcific matter to isolate the diseased horn. In the second case we have a lower molar in which the enamel has been completely destroyed by decay and the dentin decalcified nearly or quite to the pulp. The caries for some reason stopped at this stage and the decalcified dentin became hard and black. In other words, it is a case of self-healing of the dentin. Strangely enough, we find a self-reparative process going on in the pulp at the same time. It had succeeded in covering its whole surface with a layer of secondary dentin, except at the apex of the one horn, which shows an abscess-cavity the size of a pin-head. This pulp was engaged in encysting at the time of the extraction, having already thrown up a wall of calcific matter, thus shutting out the abscess, and it would soon have been in a perfectly healthy and normal condition if the tooth had not been unnecessarily extracted.

These cases are beyond a doubt exceedingly rare, and yet they show us that even an abscessed pulp may, without any interference from without, return to a healthy condition, and they certainly justify the inference that a skilful dental practitioner ought to be able to save a certain percentage even of abscessed pulps. And yet all our experience in the conservative treatment of the dental pulp goes to show that there is very little hope of being able to bring about a permanently healthy state in a pulp in which suppuration has once taken place, and that perhaps with very rare exceptions it is better to devitalize such pulps at once. It is, on the other hand, however,

going too far when we advocate the devitalization of pulps which manifest only symptoms of beginning local inflammation, or even of perfectly healthy pulps which have been exposed by accident in excavating.

Hyperemia and fresh cases of slight local inflammation of the pulp may be reduced with tolerable certainty by a judicious use of oil of cloves, thymol, hydronaphthol, nitrate of silver, etc. The latter has proved a very valuable remedy to me in these cases, applied in form of powder on a pledget of cotton moistened in oil of cloves or carbolic acid and sealed in with oxysulphate of zinc. It may be left in the cavity for twenty-four hours, or even longer where the caries has not approached too near the pulp. In two different cases, where the pulps were protected by only a very thin layer of decalcified dentin, I found some months later that they had suffered a painless death without giving any disturbance whatever. I could not attribute the death with certainty to the action of the nitrate of silver, though it is well to avoid an excess in such cases.

Where a healthy pulp is exposed in excavating the attempt should always be made to save it. After the cavity has been thoroughly cleaned it should be sterilized by the application of non-irritating antiseptics and the pulp capped immediately, care being taken that it does not become unnecessarily infected by access of saliva or use of unclean instruments, and that its surface does not become dried by long exposure to the air. As capping material everything should be rejected which does not adapt itself perfectly to the surface of the pulp without the use of the least pressure. I invariably use oxysulphate of zinc, mixing it to a thin paste. With an instrument, with which I can easily reach the surface of the pulp I take up a quantity the size of a large pin-head and bring the paste, not the instrument, into contact with the surface of the pulp, when if it is of the proper consistency it will flow off the point of the instrument and spread out over the exposure.

If it is deemed desirable a small quantity of finely pulverized thymol may be mixed with the cement in order to secure a slight permanent antiseptic action. I have made use of this method for fifteen years at the Dental Institute of the University of Berlin, and have been surprised to see how seldom it fails, even in the hands of students. Of course one must work quickly with the oxysulphate; the moment it begins to harden it ceases to flow, and is then abso-

lutely unfit for capping purposes. I find this method better than that of applying the paste by means of a cap, as the latter cannot be adjusted without a certain amount of pressure, and one cannot see what is taking place under the cap. After the pulp has been protected by the first thin layer of the oxysulphate there can be no objection to then applying the cap, but a layer of oxyphosphate serves the purpose better when it is desired to fill immediately with any material requiring much pressure for its insertion. As a rule I allow a year to intervene between the capping of an exposed pulp and the insertion of the permanent filling.—International.

SYNOPSIS OF FACTS IN CONNECTION WITH DEN-TAL CARIES. By Otto E. Inglis, D. D. S. Dental caries may be defined as a disease of a tooth resulting from localized oral fermentation and characterized chiefly by the production of a concavity containing softened dentin. The cause has been sought for decades, but until Miller in 1884 published his researches no satisfactory demonstration of it was known, though the names of many are honored for their labors in this direction. Miller's work may be summarized as follows: (1) He examined thousands of sections of decayed dentin and always found microorganisms present, and in the deeper layers he was generally able to find a germ capable of reproduction in nutrient media in pure culture. (2) He further found that almost invariably the liquid which could be squeezed from the softened dentin gave an acid reaction. These two facts suggested a combination of these two forces at work to compass the destruction of the tooth substance, which was proved by the following facts: (3) The germ found in the deeper layers was capable of cultivation in solutions of albuminous material both with and without the addition of sugar. When saliva (ptyalin) or pancreas extract (amylopsin) was added starch served in place of the sugar. (4) When cultivated in albuminous solutions without starch or sugar an alkaline reaction was produced and slabs of dentin placed therein were not affected. (5) When to the albuminous solution sugar (or starch with a diastasic ferment, as saliva [ptyalin]) was added an acid reaction was produced, and slabs of dentin were artificially decalcified and decayed. From these and similar experiments, in connection with other facts, he concluded that putrefaction alone does not cause caries, but that acid fermentation does.

(6) That the acid produced is lactic acid he demonstrated by obtaining a quantity of acid from a fermenting sugar or starch containing solution. This he concentrated by boiling. The concentrate was tested by methyl violet and found to react as an organic acid. This organic acid was taken out of the concentrate by the addition of ether, which when clear was decanted into a retort and the ether distilled off, leaving a concentrated organic acid. This was tested by Ewald's test (which gave lactic acid) and by mixing with freshly prepared zinc oxid, when upon crystallization zinc lactate crystals were found. This experiment was practically duplicated by the liquid obtained from the decalcified dentin of several freshly extracted teeth. (7) The fact that a series of similar solutions, sterilized, could be infected in turn by a minute quantity taken from the preceding number of the series, and that a quantity of acid would be produced in each, was proof that the ferment was a living organism capable of reproduction. As a further test of this Miller sterilized infected nutrient solutions, with the result of preventing acid fermentation (8) The organism so cultivated was examined in the sediment of cultures and found to agree morphologically with the bacterium of lactic acid. Another organism was also found. (9) Miller further experimented upon mouth bacteria and found that out of eighteen examined ten would produce lactic acid in solutions containing sugar under favoring conditions. (10) When the infected solutions were deprived of oxygen the acid was still formed, the organism thus being proved anaërobic. (11) From the observations by himself and others Miller showed that millers and confectioners were much subject to caries. (12) The sugars of the glucose group (dextrose, levulose, and maltose) were shown to be directly fermentable into lactic acid; while cane, maple, beet sugar, and milk sugar require hydration under the inverting action of the bacteria whereby they are split into dextrose and levulose. These are then directly fermented into lactic acid according to the formula

 $C_0H_{12}O_0 = 2C_0H_0O_0$ (lactic acid).

Starch is first hydrated into glucose by the ptyalin of the saliva, and in the mouth as well as externally forms as much or more acid than sugar. Miller's experiments to determine this are interesting. With a definite quantity of the food to be tested he mixed a definite quantity of saliva and estimated the amount of acid units present

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by the number of definite portions of an alkaline solution required to neutralize the product. In the case of sugars and cooked starchy foods he found a large number of acid units (20 to 25) after 12 hours, and still more (40 to 75) after 30 hours. The albuminous foods gave only alkaline reactions. Raw vegetables (uncooked starchy foods) gave no acid reactions, nor did fats. (13) He proved that the bacteria first cause the fermentation of carbohydrates and that thereby lactic acid is produced which combines with the calcium and magnesium salts of the tooth, producing calcium lactophosphate, calcium lactate, and magnesium lacto-phosphate. This action neutralizes the acid and removes the bar to further development of the germs, as they cease to live in solutions containing .75 of one per cent of lactic acid.

(14) He proved by microscopic sections that a considerable area of uninvaded decalcified dentin may underlie the area of bacterial invasion. He showed that this action proceeds from without inward, the enamel always being first attacked where it overlies the dentin, though the dentin and cementum may be alone affected where no enamel overlays them. Regarding the initial action of the causes of caries upon the enamel surface it is agreed that it occurs at such spots as are liable to retain food debris which is not removed by the ordinary attrition occurring from mastication, cleansing movements of lips or tongue, or removal during the act of cleansing.

Williams demonstrated that at the point of inception a felt-like mass of bacteria is tenaciously adherent to the enamel. He claimed that to this mass the food comes in solution or mass and supplies the bacteria with carbohydrates which they change to lactic acid, which then exerts its solvent action upon the calcium salts of the enamel. Miller in a later article claims that such a mass may be seen at points not subject to caries and in mouths presenting no decay at such points, and again refers the casual action to the food masses. It would seem, however, that it may be that both the felt-masses and the food retention are required as a full complement for the production of caries.

(15) He proved that when the tissues of the tooth are decalcified the organisms enter the tubuli, or also later lie upon the surface of the cavity. Here they exert a digestive (liquefying) action through their unorganized ferments and destroy the tubules and

intertubular substance. The action is first exerted upon the inner part of the walls of the tubules, which swell in the process. Their destruction at a point beneath the general cavity surface permits the digestion of the intertubular substance and the formation of a minute cavity in the decalcified dentin known as a liquefaction focus. By the action of the bacteria in this manner and upon the surface of the organic matrix represented by the decalcified dentin the latter is completely destroyed and washed away. The action proceeds progressively and gradually from the surface inward. Miller determined by weighing equal volumes of decalcified and sound dentin from the same tooth that the sound dentin had lost seven-ninths of its weight. Of this loss he determined by analysis of the sound and decalcified masses that twelve-thirteenths of the inorganic matter were lost by the decalcifying process, and that two-fifths of the organic matter were lost by putrefaction. This leaves as the matter making up the decalcified dentin three-fifths of the original organic matter, one-thirteenth of the inorganic, and the bacteria adventitiously present.

It was the opinion of Miller that, while one organism at least could in pure culture be made to accomplish the entire process of artificial caries, it was still impossible for him to state that any one germ was responsible for the entire process in the mouth, for the reason that many germs were found to be taking a part in the process. He summed the matter up in the statement "that germs possessing the power of producing acid fermentation of foods may and do decalcify the teeth, and that all possessing the peptonizing action upon albuminous substances may take part in the liquefaction of the organic (albuminous) dentinal matrix." It is of course understood that the stages of decalcification and liquefaction progress together, once the tubules are invaded, and that the decalcification is always in advance.

In the tubules of dentin decayed either naturally or artificially there occur rod-shaped, cylindrical formations known as "tube casts," in the interior of which may be filaments, possibly remnants of dentinal fibrils. The fact that these casts are soluble in sulphuric acid and not in organic acids would seem to show that they are composed of calcium and magnesium lacto-phosphate and calcium lactate, or in other words, that they are the above salts produced by a combination of lactic acid with the calcium salts of the tubule

wall and intertubular substance and cast into a cylindrical form against the tubule wall. Their breaking up would account for the rod forms, and their further comminution for the granule-like particles found in some specimens. The proof of the truth or falsity of this theory rests probably with what future investigations in

this direction with the polariscope may show.

Once the enamel is locally destroyed the dentin becomes the surface to which the bacteria adhere. From this surface they are less likely to be rubbed off by the oral friction, so that their biological processes are uninterrupted. Again, the dentin is a substance less impermeable than the enamel. For these reasons the dentin is destroyed more rapidly and in such a manner as to undermine the enamel. This exposes the inner ends of the enamel rods to the action of the acid, etc., and they are decalcified and rendered opaque in appearance thereby. Being weakened thus and being unsupported, the enamel readily breaks down and the cavity orifice usually enlarges with the cavity interior. It often happens, however, that a cavity discovered with difficulty mechanically may involve a half or more of the crown dentin and its contents may reflect through the enamel as an opaque white, bluish or gravish discoloration. Opacity is due to the decalcified under-surface of the enamel and is a diagnostic sign.

The natural result of caries unchecked is the exposure of the pulp. In the more active varieties of decay this occurs within a few months after the process has reached the dentin, but it is probable that the pulp offers through the dentinal fibrils and the odontoblasts some form of organized resistance by the production of what is known as the "transparent zone," a band of translucency completely surrounding the area of decay except upon its exposed This has been called an area of beginning decalcification, a position disproved by Miller on the following grounds: (1) Transparency indicates increased homogeneity as opposed to the heterogeneity of normal dentin. The coefficients of light-refraction are brought closer together. (2) It occurs in decay of living dentin only, and is not found in natural teeth mounted on plates and decayed in the mouth. (3) The tubules have their lumen lessened in diameter in the transparent area. (4) Secondary dentin may accompany the process and indicates a protective and constructive excitation of the odontoblasts of which the fibrils are prolongations.

(5) Chemical analysis proved that no lime salts had been lost, and it was pointed out that a gain in the percentage of salts was unnecessary, as new dentin is necessarily composed of organic as well as inorganic matter, wherefore the analysis would not necessarily vary from that of normal dentin. (6) It is found in connection with abrasion of human teeth, in which case the activity of acid may possibly be an open question, and it also occurs in worn teeth of animals the saliva of which is strongly alkaline, in which case the decalcification theory is at rest.

Pigmentation occurs in caries possibly from extraneous substances, possibly from the substances formed during putrefaction. The exact nature of the discoloration does not seem to have been shown. The slower the progress of the decay the greater the change from the light yellow (lactic acid yellow) color of the dentin to the light brown, or dark brown or black color. The discoloration of dentin does not seem to be necessarily due to the carious process, as it may be seen in areas of abrasion. In a specimen possessed by the writer a limited cervical caries caused a growth of secondary dentin and probably an area of tubular calcification. From the pulpal wall of the secondary growth to the area of caries extends a sharply defined area, which has a flesh rose color. Again, on the pulpal wall of many cavities we find brown or black discolorations where no decalcification is apparent.

The leaving of such dentin is accepted as good practice by those who are opposed to the leaving of any decalcified dentin beneath fillings. After pulp exposure its death sooner or later results. Food masses now enter the pulp cavity and decay proceeds from within out until the cementum is reached and destroyed, when the tissue of the pericementum enters and hypertrophies into what is known as a gum polypus or fungous gum. The reverse of this condition may occur and the pulp may hypertrophy, forming a pulp polypus or fungous pulp. In the latter case the upper portion of the crown may crumble away, leaving the polypus exposed to mastication. The writer has seen as many as five of these polypi in one mouth.

After the pulp cavity is entered the crown soon breaks down, when caries of the root continues. The dentin is usually removed first, and as the root is extruded the cementum is also liquefied. The decay and extrusion complete the approximate destruction of

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the root end, which usually loosens and is removed. In the extension a root is occasionally forced up sidewise.

Conditions Favoring the Inception and Progress of Caries. The etiology of dental caries is of such complex nature that many writers have confused the exciting with the predisposing causes. Examining the premises it is first seen that dental caries is caused by the action of certain microorganisms upon fermentable carbohydrates, and that decalcification of tooth structure is an incident which exposes the remaining organic structure to a second character of fermentation (putrefaction). The process is therefore bacterial in origin. As it can be conducted outside the mouth, the latter must be regarded purely as a laboratory in which the conditions favorable to the life of caries fungi are observed or not according to what occurs in it.

At the present time Gould's Medical Dictionary defines predisposition as "a susceptibility to infectious diseases and implies a peculiar condition of the bodily juices or cells in which these are unable to repel the invasion of pathogenic microorganisms." The same author defines a predisposing cause as "that which tends to the development of a condition."

The teeth being, in so far as the caries of enamel is concerned, simply inert bodies, their structure, form and arrangement can act only as conditions favoring the attachment of microbic plaques or the retention of food masses. Certain characters of enamel surface (smooth or rough), and certain forms of approximation of teeth (V-shaped or flattened) must necessarily be unfavorable to such collections, or the reverse. While, therefore, these favoring conditions would seem "to tend to the development of a condition," they are hardly to be placed in the same category as the weakened lung structure subject to the attack of the ever-present tubercule bacillus.

Predisposing Cause of Caries. As individuals may have attacks of caries and periods of immunity, or some careless individuals may have no dental caries, while others apparently careful are subject to it, the question has arisen as to the cause of this. The present idea is that some change in the systemic condition of the individual favors the attack by permitting the growth in the mouth of bacteria, probably normally foreign to it. That during periods of immunity or of attack the saliva has no antiseptic property has been shown.

The previous establishment in the mouth of bacteria which do not produce caries or the intense phagocytosis upon the buccal parietes may account for immunity from caries, and it is quite possible that systemic states may change the oral conditions so as to favor the implantation of the caries fungi in place of others. No doubt numbers must count in this struggle for existence, therefore each new and neglected cavity must be a source of great reinforcement to the new culture. Many general conditions may no doubt act as general predisponents to caries in this way. The question is one relating to the inception of caries alone and seems in part to be apart from dental structure, form and arrangement, though these serve as favoring conditions. Once the carious process is established, no tooth structure seems able to successfully resist if the oral conditions continue favorable to the bacteria.

As caries usually begins at spots which favor the inception of the process, one naturally looks for cavities or evidences of softening at these spots. A sharp explorer ordinarily decides the existence of a cavity by penetrating it or softened dentin. In case of a fissure doubt may exist. A good rule is to press the sharp explorer into the fissure; if it binds or sticks slightly when withdrawn a cavity is diagnosed. If it come away freely the spot may be passed. A mistake may be made and a fissure with undecayed dentin beneath be opened. It is, however, only an exceptional occurrence; the fissure will usually be found decayed.

While floss silk will as a rule fray when drawn between two teeth one of which is decayed approximately, it may pass freely over small cavities discoverable with a delicate explorer, also the latter at times fails.

The electric mouth lamp offers a positive means of diagnosis in such cases. The caries shows a dark opaque spot against a pinkish tooth tissue (if vital). The depth of penetration is thus easily determined. A cavity may be evident to direct vision or inferred from the peculiar whitish or bluish opacity of the enamel at the occluso-proximal angle or the linguo or bucco-proximal angle.

The character of the cavity seems to have some bearing upon the rapidity and depth of the caries. A cavity sheltered from frictions usually is found to be associated with a considerable degree of decalcification, while one with its enamel covering broken away so as to expose the cavity to constant friction of food mastication,

saliva currents, brush-friction, etc., has often but little depth of decalcification and sometimes none. This seems due to, first, the removal of such dentin as has been already decalcified; second, to the removal of bacterial plaques, at least those capable of producing caries; third, prompt neutralization of acid, if formed, by the saliva; fourth, stimulation of dentinal fibrillæ to resistance and self-obliteration (tubular-calcification). These factors when potent result in a polished cavity surface, usually discolored. The condition is termed "eburnation." The eburnation or tubular calcification also occurs in abrasion and erosion. In some cases both this eburnation or "healing of caries" and progressing decay may be noted in the same tooth. The latter will always be found at a comparatively sheltered spot.

In some cases small black spots of incipient caries in favorable situation, which persist for years, are seen. At some past time the carious process was active in the mouth, but is now in abeyance—i. e., the oral or local conditions are unfavorable to the particular germ-life. This is again shown by the fact that if caries has begun upon two approximating surfaces, and the enamel or even the dentin has been affected, it may cease with the loss of one of the teeth. Such "decay marks" may frequently be seen and passed over year after year.

The waste products of fermentation about a cavity of decay produce irritation of the dentinal fibrillæ, which, while not capable of the phenomena of inflammation, inasmuch as the lumen of the tubule does not admit white corpuscles, are nevertheless capable of a certain degree of functional exaltation or depression. The result is a hyperirritability of these fibers, which renders them more easily affected by irritants, such as thermal changes, sweet, salt or acid substances, other chemical agents, and mechanical irritation. This condition is known as "hypersensitive dentin," and is apt to be most pronounced in cavities in teeth of individuals whose normal dentin is most sensitive to cutting instruments.

That acids are a determining factor in the production of hypersensitive dentin is shown by the fact that during seasons in which acid fruits are largely consumed by an individual the saliva assumes an acid reaction and hypersensitive dentin frequently appears at exposed necks of many teeth. A course of local and systemic alkaline treatment is frequently competent to effect a comparative cure. To this stimulation of dentinal fibrillæ may be attributed that functional exaltation which leads to tubular calcification and secondary dentin.—Stomatologist.

NERVOCIDIN. By Theodore Söderberg, D.D.S., Sydney, N. S. W., Australia. As my short article, "Notes on Nervocidin," published in the *Cosmos* for November, 1901 (DIGEST, February, 1902, p. 128), apparently has failed to arouse the interest of American and Australian dentists in this new alkaloid, and as I now more than ever before feel convinced that nervocidin is destined to occupy a permanent and prominent place in dental practice, I have thought it desirable to bring forward the subject again.

Literature on Nervocidin. In a paper entitled "History of Pulp-Capping, Pulp-Mummification, and Root-Treatment, and their Present Status," read before the Stomatologists of Budapest on September 29, 1900 [see Vierteljahrsschrift für Zahnheilkunde, October, 1900], Dr. D. Dalma announced his discovery of nervocidin, an alkaloid (hydrochlorate) obtained from the bark of the gasu-basu, an East-Indian plant. The discovery was the outcome of a series of competitive experiments for the Herbst prize. Dr. Dalma's announcement, although at the time accompanied by very few comments, was nevertheless of sufficient importance to induce Professor Arkövy and those on the staff of the dental and pharmacological departments of the University of Budapest to commence a series of fundamental experiments. The results were published in two articles: "Investigations into the Pharmaco-Dynamic Effect of Nervocidin," by Professor Arkövy (op. cit., April, 1901), and "Preliminary Information on the Clinical Use of Nervocidin," by Drs. Madzar and Balassa (op. cit., October, 1900). The following is a resume of the chief points of those articles:

Chemistry of Nervocidin. Nervocidin is a yellowish, hygroscopic powder, containing N, C, H, and Cl. Its exact chemical composition has, however, not as yet been ascertained. It is very soluble in water, slightly soluble in ether and alcohol, and when moistened becomes jelly-like and very sticky. On addition of alkalis the solution becomes opaque.

A two per cent solution painted on the eye of a rabbit produced total anesthesia of the cornea after fifteen minutes. The following day the cornea was insensitive, opaque, and bloodshot, and after

torty-eight hours typical keratitis ulcerosa and conjunctivitis appeared. On the third day the eye was closed, on account of a profuse formation of pus. From the sixth day a gradual improvement took place until the twelfth day, when the cornea was clean, clear, and sensitive, and the eye normal.

Experiments on Dosage. To determine the concentration in which nervocidin could be used for the production of local anesthesia without inflammation, decreasing strengths of the solution were next used. A ½ per cent solution produced hardly any inflammation; the cornea remained dull for forty-eight hours, while anesthesia lasted four days. A 2:1000 solution produced after twenty minutes anesthesia which lasted three days without producing inflammatory disturbances. A 1:1000 solution produced an anesthesia which lasted forty-eight hours, and no inflammation. Two drops of a ½:1000 solution dropped into a human eye produced a mild burning sensation and lacrymation, loss of sensitiveness after twenty minutes, and an anesthetic period of five hours. A 1:1000 solution painted on the mucous membrane and tip of the tongue produced local anesthesia with loss of taste; reaction to heat and cold remained normal.

To ascertain the toxic effect of nervocidin, 5 milligm, were injected subcutaneously in a rabbit weighing 900 gm. Death ensued after two and one-half hours. In another case a rabbit weighing 1150 gm. died after twenty hours as the result of an injection of 21/2 milligm. The symptoms were in both cases similar, viz., tremor of the extremities, muscular paralysis, paralysis of respiration, and finally cardiac arrest. With the exception of a slight hyperemia of the brain and spinal cord no visible pathological changes could be observed. Another rabbit, weighing 1300 gm., received daily for five days an injection of I milligm, of nervocidin. It became quiet, but ate. On the sixth day 3 milligm. were injected. Death followed after sixteen hours. The injection of 5 milligm. of nervocidin subcutaneously into a dog weighing 8 kilogm. produced loss of appetite and drowsiness; recovery after two days. The same dog then received I centigm, subcutaneously at 6 p. m., and was found dead at II a. m. next day; dissection showed diastolic paralysis of the heart.

These experiments show, then, that nervocidin is a poison which acts by producing paralysis of the nerve-endings as well as of the nerve-centers, and that death takes place through paralysis of the

motor centers, and thus indirectly through paralysis of the heart. Further, that the organism is unable through habit to withstand the normal lethal dose.

Of great interest is the singular effect of nervocidin in producing the severest keratitis ulcerosa, which appears to threaten the eye with destruction, while nevertheless all symptoms shortly disappear without a transition to panophthalmitis, yet anesthesia continues and even outlasts the keratitis.

Of great importance to the dental practitioner is, of course, the established fact that we have in nervocidin a local anesthetic which, as far as the duration of its effect is concerned, leaves all other previously known local anesthetics far behind.

So far the first fundamental experiments. The results of the clinical experiments were equally interesting. Those experiments were not undertaken to test nervocidin as a devitalizing agent; for although in the recorded forty-four cases extirpation of the pulp was the operation in view, it was principally the anesthetic power of nervocidin in connection with that operation which was clinically tested. Its effect as a local anesthetic for hypodermic purposes, and its utility for the painless excavation of sensitive teeth, were not tested.

In the article in question, as well as in two critical articles which followed, viz., "On the Effect of Nervocidin on the Dental Pulp," by Professor Scheff, University of Vienna (op. cit., April, 1902), and "Observation of Teeth Treated with Nervocidin," by Dr. T. Kaas (ibid., October, 1902), the subject was, then, the comparative study of nervocidin and arsenic as agents for pulp-extirpation, the one anesthetizing, the other devitalizing. As all practitioners are familiar with the effects of arsenic, I shall give the opinion of the writers only on the use and effect of nervocidin.

Technique of Application. Nervocidin should be sealed in the cavity with any of the various cements. If a minute quantity of the alkaloid comes in contact with the tongue and mucous membrane, temporary loss of taste and the formation of small inflammatory spots (which disappear after two days) are the results. Where it has to act through a layer of dentin two applications are generally necessary, one for the painless opening of the pulp-chamber, another for the painless extirpation of the pulp. Owing to the sticky nature of nervocidin when moistened, the difficulty of placing it in its cor-

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rect position is best overcome by moistening the under surface of a piece of spunk, then gripping the dry upper surface of the spunk with the pliers, the nervocidin is taken up and the pellet placed in situ. The amount of nervocidin used is in each case the same as arsenic. If precaution as to pressure on the pulp be taken the pain produced by nervocidin is considerably less than that produced by arsenic; it seldom gets beyond an uneasy feeling in the tooth, lasting from one-half to two hours, according to the state of the pulp. The application is best left in situ for from twenty-four to forty-eight hours: if allowed to remain longer than three days the tooth in some cases becomes tender to pressure; if left still longer the tenderness disappears and after a month or two the pulp returns to its original state of sensitiveness. Nervocidin brings about anemia of the pulp. The alkaloid does therefore not discolor the tooth, or only very slightly. Destruction of gum tissue through leakage cannot take place. Like arsenic, nervocidin is contraindicated in septic pulpitis.

I shall now give the results of my own experiments with nervocidin, the use of which I commenced in June, 1901. I must, however, first state that I do not now write about the effect of nervocidin per se, my aim being to test the accuracy of some of the statements by Arkövy, Madzsar, and Balassa concerning the effects of the pure alkaloid, and to record its effect on the pulp when used in combination with other chemicals.

What I—with all other dentists, I should think—hankered after was an agent which would enable the operator painlessly to prepare the most sensitive cavity of a tooth without destroying the vitality of its pulp. We are fairly satisfied with arsenic as a devitalizing agent; we are fairly satisfied with cocain, eucain, and other agents as local anesthetics for extraction, etc., but who can truthfully say that he is even moderately satisfied with any of the hitherto-used remedies for that horror of all patients—sensitive dentin?

Now, the first inference which I drew after noting the recorded experiments on the eyes of rabbits was that nervocidin probably was the desired agent, and it struck me as strange that no clinical experiments were undertaken—or at least that none was stated to have been undertaken—to permit us to draw conclusions regarding this point. I therefore soon commenced to experiment with nervocidin on the lines indicated. Care had of course to be observed in selecting the right class of patients, and to make certain that the teeth treated

had healthy pulps. All teeth where the extension of decay was thought likely to threaten the pulps with the inroad of microorganisms were excluded from the list of test cases. My procedure was as follows: Ten grains of nervocidin and ten grains of cocain hydrochlorid are dissolved in two drams of the fluid of a zinc oxysulfate preparation, viz.:

B—Gum arabic, 5; Zinc sulfate, 5ss; Water, 5j.

Dissolve the zinc sulfate in the water, then add the gum arabic, stir; let stand for twenty-four hours; strain. As powder, use uncalcined zinc oxid. A cement is then made by mixing some of this stock fluid with the necessary amount of the powder.

The cement was placed in the previously dried cavity, where it was left for from two to forty-eight hours. A painless preparation of the cavity was the first pleasant result. The prepared cavity was next soaked for five minutes with a weak aqueous solution of ammonia to neutralize the acidity of the nervocidin; it was then dried, soaked for another five minutes with eugenol, and finally filled with gutta-percha or eugox (eugenol-zinc oxid). The teeth thus treated were examined and permanently filled after intervals ranging from a month to a year. Of thirty-five teeth examined to date, all pulps responded to the ordinary tests for vitality and health, and in the vast majority of cases the dentin had returned to distinct sensitiveness, although not to the original state of hypersensitiveness.

An Excellent Obtundent. These results should, then, go far toward proving the accuracy of Professor Arkövy's opinion, expressed in October, 1900, that it was not impossible that nervocidin would turn out to be a valuable non-devitalizing agent for the painless excavation of sensitive dentin.

I did not test the minimum time required for the anesthetic effect of nervocidin. The shortest time record I have is one and a quarter hours, that particular case being a success. Dr. Dalma states, however, that nervocidin did not come up to one of the conditions necessary to win the Herbst prize, viz., full effect after ten minutes' action.

My reason for using cocain with the nervocidin was to reduce the pain of its application to a minimum. I think that the results must be called satisfactory, as of these test cases fully seventy-five per cent were painless, while the remainder varied from "an annoying

sensation" to "a mild toothache" lasting from half an hour to two hours.

Those dentists who have faith in the possibility of saving exposed diseased pulps will probably find in nervocidin an ideal agent for their experiments. Owing to its marvelous anesthetic power, and its anemic and non-destructive effects, it will be possible by its help to more thoroughly treat diseased pulps antiseptically than has hitherto been practicable. Nervocidin is, however, not an antiseptic.

Nervocidin in Pult-Amputation. And this brings me to the question of the use of nervocidin in connection with pulp-amputation, an operation which stands midway between the radical extirpation and the ideal conservation of the pulp, and for which I am personally an advocate. Briefly stated, the operation consists in cauterization (arsenic) or anesthetization (nervocidin) of the pulp, amputation of the coronal part, and insertion (under a permanent filling) of an antiseptic paste over the vital pulp-remnants in the root-canals, the paste mummifying the minute dead particles while conserving the live remnants. This is theoretically the process; but practically we often find that arsenic penetrates deeper than we wish, and instead of a cauterization of the coronal parts only we often find an almost total devitalization, which for safety's sake necessitates amputation of the root-pulp close to the foramen, in consequence of which the strong paste is liable to cause irritation in the apical region. It would therefore doubtless be an advantage to use nervocidin instead of arsenic in all cases of pulp-amputation, a further point in favor of the former being its production of local anemia. A disadvantage—when time is a consideration—is the necessity for two applications of nervocidin when a thick layer of dentin has to be penetrated.

Whether amputation or extirpation be resorted to, I cannot too strongly recommend the use of nervocidin instead of arsenic for the incisors, cuspids and first bicuspids. The unsightly discoloration of the visible teeth frequently resulting after pulp-devitalization with arsenic ought—now that we have nervocidin—to be a thing of the past.

There remains to be mentioned the combination of nervocidin and arsenic. I use arsenii sulphidum citrinum (Merck) q. s., together with equal parts of nervocidin and cocain, taking up the three parts on the spunk in the order mentioned. The results are very satis-

factory, and I wish to recommend this combination where an arsenical application is required.

The question naturally arises: If, according to Arkövý's experiments, two drops of a 1/2:1000 solution of nervocidin suffice to produce five hours' anesthesia of the cornea of a human eye, without any inflammatory symptoms arising, could not nervocidin in correspondingly weak solution be successfully used hypodermically for extractions, etc.? Taking the experiments on the dog as a base of calculation, a comparatively safe (non-toxic) dose for injection into the human gum would be five drops of a one per cent solution. This would, however, probably cause considerable inflammation and pain. I have experimentally injected three drops of a 1:1000 solution of nervocidin into my gum and the same quantity into my arm. No inflammation took place, but the local anesthesia was very weak and its area very small. A pricking pain lasted about half an hour. It appears to me that the indications for the future use of nervocidin as a local anesthetic in the hypodermic form are unfavorable. It is, however, to be hoped that an antidote to nervocidin will soon be found, which will permit the undertaking of further experiments in this direction.

Nervocidin is put up in bottles containing one gram (price, \$2.50). The powder being hygroscopic, the original bottle ought to be kept well sealed after transferring a small quantity to a vial having a waxed cord. Should, in spite of these precautions, the powder become lumpy, it can be dried and powdered again, care being taken that particles do not come in contact with eyes and nostrils.

I sincerely hope that the recorded experiments will be the means of inducing American and Australian dentists to devote some attention to the valuable alkaloid which Dr. Dalma's discovery has added to our materia medica. I feel confident that nervocidin will then be as highly appreciated by the profession as it is sure to be by the public.—Cosmos.

To Secure Parallel Walls for Anchoring Bridgework.—F. Rose, Brit. Dent. Jour. Two half-collars are made accurately fitting under the free margin of the gum and up to or above the most prominent point of the contour; they are thickened out from the gum margin, a rapid bevel being continued to the bottom, below the gum margin, so that when they are placed around the tooth a pillar with perfectly parallel walls is formed; lugs are carried over the crown to prevent the collars from being pressed down by the cap which is fitted over all. Cement as usual.

Letters.

DENIAL BY A. C. CLARK.

Chicago, December 24, 1903.

To the Editor of the DIGEST.

Dear Sir:—Some time ago my attention was called to the fact that in a circular dated Nov. 6, 1903, my name was used as a reference by a concern styling itself the International Cooperative Dental Association, with offices in Chicago. I at once wrote Dr. Melze, the president of the Association, demanding an explanation. Under date of Nov. 16 Melze replied that he was sorry he had used my name without my authority, and that he did not intend any injury to me thereby. Other than that he gave no explanation for his action. I have learned that they also used the name of Dr. J. Roland Walton of Washington, D. C., without any authority, putting his name on their list of directors without his consent and knowledge, and I have no doubt that other names were used without warrant.

As you can well understand, the use of my name in connection with a concern of this character has been a great annoyance to me. I have had to explain to a number of people that I was not in favor of it, and I now wish to put myself in record in your columns.

Some days ago I went over the matter with my attorney, and after looking over the prospectus of the Association he tells me that the organization is being used for an illegal purpose. He has suggested the advisability of laying all the facts before the State's Attorney, and assures me that if we do this we could without question have the officers of this Association indicted. This I intend to do.

Yours truly,

A. C. CLARK.

The Dental Digest.

PUBLISHED THE FIFTEENTH DAY OF EVERY MONTH
At 2231 Prairie Avenue, Chicago,
Where All Communications Should be Addressed.

Editorial.

SOME FACTS CONCERNING THE INTERNATIONAL COOPERATIVE DENTAL ASSOCIATION.

On page 1545 of this issue we publish a communication from A. C. Clark of Chicago which is self-explanatory. During the past month we have received a large number of inquiries from dentists of prominence who have received circulars from this International Dental Cooperative Association, asking what the organization was, who the men backing it were, our opinion of it, etc. To save further correspondence on both sides we take this opportunity of giving a few facts concerning it. The officers as given in the circular are: L. A. Melze, President; A. S. Washburn, 1st Vice-President; L. Motts, 2d Vice-President: Wilber Hamlin, Treasurer: Gus Melze, Secretary. Washburn and Hamlin are listed in the directory as doctors of osteopathy, and L. Motts is not given in any dental directory. so the two Melzes seem to be the only dentists who are officers. The circular says, "In organizing the dentists of United States and Canada in one solid association we are striving to suppress the cheap advertiser or dental pirate." To the dentists of Chicago and Illinois this statement is excruciatingly funny. For years "L. A. Melze and Sons" have been advertising themselves and their dental parlors in numerous ways. A picture of the father with his patriarchal beard and a picture of a son on either side of him have been seen in the newspapers, on placards in store windows, and in many other public places. We have seen their ads within a short time, so do not believe the Melzes have decided to give up advertising. We were not aware that there was any difference in dental advertisers, but there must be, since the Melzes wish to suppress "the cheap advertiser or dental pirate." Think of the colossal impudence of these Melzes, who have advertised for years, asking the reputable dentists to join them in a campaign against other advertisers. After this expose of the men back of the scheme further comment seems unnecessary, but there are one or two other points upon which comment might be

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made, although the absurdity of the plan as outlined must be apparent to everyone.

The organization charges a membership fee of \$5 and dues of 25 cents per month. All the circulars that we have seen offer to omit the membership fee if the dentist will allow his name to be used as an officer or director. Comment on this is unnecessary.

The International Cooperative Dental Association proposes to force the dental manufacturers "to stop selling goods to the cheap advertiser, thus forcing the advertiser into our Association in order to get material with which to do business. We will not accept him unless he adopts our schedule of prices." It is also proposed to boycott manufacturers who do not fall into line. In other words, the idea seems to be to force all dentists into a sort of labor union and we presume the Melzes are to decide the "schedule of prices."

Motices.

NOTICE CONCERNING INDEX FOR VOLUME IX.

The index for Volume IX of The Digest will be mailed to subscribers with the January issue.

DISTRICT OF COLUMBIA DENTAL SOCIETY.

The annual meeting and banquet of the District of Columbia Dental Society were held in Washington Dec. 15, 1903, and the following officers were elected: Pres., W. D. Monroe; V.-P., S. W. Bowles; Cor. Secy., Charles Diedel; Rec. Secy., A. J. Brown; Treas., M. F. Finley; Librarian, H. C. Thompson.

· OHIO STATE DENTAL SOCIETY.

At the thirty-eighth annual meeting of the Ohio State Dental Society, held at Columbus Dec. 1-3, 1903, the following officers were elected: Pres., J. F. Stephan, Cleveland; 1st V.-P., W. T. McLean, Cincinnati; 2d V.-P., H. L. Ambler, Cleveland; Secy., S. D. Ruggles, Portsmouth; Treas., C. I. Keely, Hamilton.

S. D. Ruggles, Secy.

REUNION CLASS OF '91 NEW YORK COLLEGE OF DENTISTRY.

A reunion of the Class of '91 of the New York College of Dentistry will be held in New York Jan. 30, 1904. A full representation is desired, and members unable to attend are requested to send letters to be read. For information communicate immediately with W. H. McCutcheon, Crescent Club, Brooklyn, or W. D. Provost, 352 Stuyvesant Av., Brooklyn.

NEW HAVEN DENTAL ASSOCIATION.

At the annual meeting of the New Haven (Conn.) Dental Association, held Dec. 8, 1903, the following officers were elected: Pres., F. W. Brown; V.-P., E. S. Gaylord; Secy., E. F. Cory; Treas., H. A. Spang; Exec. Com., J. Tenney Barker, chairman, A. F. Slater, F. C. Parsons; Finance Committee, E. S. Thompson, H. S. Nichols, G. E. Nettleton. The association will hold a convention in New Haven in March. The date, program, etc., will appear in the next issue of the Dental Digest.

E. FRANK CORY. Secv.

news Summary.

S. B. Howell, 72 years old, a dentist at Philadelphia, died Dec. 12, 1903.

M. Lukens Long, 77 years old, a dentist of Philadelphia, died Dec. 1, 1903.

THOMAS E. Ross, formerly a dentist in Boston, 62 years old, died Dec. 9, 1903.

EDGAR C. SWAIN, a dentist at Cleveland, O., committed suicide Dec. 22, 1903.

H. SATTERWHITE, 72 years old, a dentist at Martinsville, Ind., died Dec. 11, 1903.

A. M. ESTERLE, a dentist at Oakland, Cal., died Nov. 17, 1903, from cancer.

HENRY LEAVITT, 63 years old, a dentist at Skowhegan, Me., died suddenly Dec. 1, 1903.

H. S. Terry, 26 years old, a dentist at Detroit, died Dec. 15, 1903, from typhoid fever.

H. S. DOUTHETT, 25 years old, a dentist at Pittsburg, died Dec. 8, 1903, of typhoid fever.

WM. T. Allison, 71 years old, a dentist at Indianapolis, Ind., committed suicide Dec. 5, 1903.

T. J. SPENCER, 53 years old, a dentist at Falls City, Neb., died Dec. 12, 1903, after a long illness.

D. T. Porter, 76 years old, a dentist at Lawrence, Mass., died Nov. 21, 1503, from heart disease.

R. D. Brown, 61 years old, a dentist at Springfield, Mass., died Dec. 17, 1903, from Bright's disease.

C. S. WEEKS, 79 years old, a dentist of Bayside, N. Y., died suddenly from apoplexy Nov. 24, 1903.

WM. M. WARREN, general manager of Parke, Davis & Co., died Nov. 11, 1903, at Detroit, Mich., aged 39 years.

CHAS. A. BUXTON, 49 years old, a dentist, formerly of Salem, Mass., died at Quincy, Mass., Nov. 21, 1903, from heart disease.

FATALITY.—Dec. 2 a middle-aged woman near Ogdensburg, N. Y., died in a dentist's chair under chloroform given for tooth extraction.

PUNISHED BY TOOTH PULLING.—It is reported that the superintendent of an insane asylum in Missouri recently had all the teeth pulled from the mouth of a woman patient.

Springfield (O.) Dental Society held its annual meeting Dec. 16, 1903, and elected the following officers: President, E. G. Barnett; Secretary, H. H. Smith.

DANVILLE (ILL.) DENTAL SOCIETY was organized Dec. 7, 1903, and the following officers were elected: President, J. D. Wilson; Vice-president, E. T. Johnson; Secretary and Treasurer, H. L. Minnis.

GUTTA-PERCHA POINTS.—Gansby in *Dominion*. Don't handle gutta-percha points more than necessary nor leave them lying loose in the cabinet. Keep them in boracic acid, either the crystals or solutions.

To PREVENT PLASTER ADHERING TO FLASKS.—Paint the inside of the flask with a thick solution of whiting before pouring the plaster. This prevents corroding and the plaster comes away easily.—Hints.

Dallas (Tex.) Dental Society was organized Dec. 12, 1903, and the following officers were elected: President, T. L. Westerfield; Vice-president, W. R. Stokes; Secretary and Treasurer, C. H. Steele.

SURE DEATH.—"Medical science has made such progress," said the doctor when speaking of his profession, "that it is almost impossible for anybody to be buried alive now." Then he wondered why everybody laughed.

TRI-CITY DENTAL SOCIETY held its annual meeting at Omaha, Dec. 16, 1903, and elected the following officers: President, P. T. Barber; Vice-president, Z. D. Clark; Secretary, E. H. Bruning; Treasurer, C. D. Wallace.

SYRACUSE (N. Y.) DENTAL SOCIETY held its annual meeting Dec. 1, 1903, and elected the following officers: President, A. M. Lafayette; Vice-president, C. M. Ryan; Secretary, J. A. Dower; Recording Secretary, H. E. Webb.

PRESSURE ANESTHESIA.—W. A. Brownlee, *Dominion*. If a pellet of cotton be placed over the rubber in the cavity a much better pressure can be obtained, as it prevents the rubber from spreading so much under the instrument.

GLASS IN PLASTER BENCH.—A. W. Thornton, Brief. A piece of plate glass about a foot wide and two feet long, set in the plaster bench near the waste drawer, presents a smooth surface on which to set models, and is easily cleaned.

NORTHEASTERN MISSOURI DENTAL ASSOCIATION was organized at Hannibal, Dec. 15, 1903, and the following officers were elected: President, J. F. Wallace, Canton; Vice-president, L. A. Vandiver, Hannibal; Secretary, E. S. Brown, Edina.

Syringe Point.—R. E. Collins, Review. In washing out a diseased antrum or an abscess, use a hard rubber point on the syringe in preference to metal,

the latter causing an unpleasant shock on coming in contact with the inflamed soft tissues.

THE MYCOLOGY OF THE MOUTH.—A Text-book of Oral Bacteriology. By Kenneth Weldon Goadby, D. P. H. (Camb.), L. R. C. P., R. C. S., L. D. S. (Eng.) Published by Longmans, Green & Co., 91 Fifth Ave., New York. 1903. Price, \$3.00 net.

HUMBOLDT COUNTY (CALs) DENTAL ASSOCIATION was organized at Eureka, Nov. 14, and the following officers were elected: President, Paul M. Burns, Eureka; Vice-president, A. F. Cooper, Arcata; Secretary and Treasurer, E. R. Cockburn, Eureka.

FOREWARNED.—Bunker: "I was fool enough yesterday to tell that doctor of yours that you sent me."

Hill: "What difference did that make?"

Bunker: "He made me pay cash."

MEDICINE FOR "WORKING" PEOPLE.—The patient of a witty physician recently revolted at a monstrous dose of physic, saying, "Why, Doctor, you can't mean such a dose as this for a gentleman." "Oh, no," said the physician; "it is for working people."

How to Succeed in the Practice of Medicine.—By Joseph M. Matthews, M. D., LL.D., ex-President American Medical Association, etc. 215 pages, well illustrated. Cloth \$2.00, net. Charges prepaid. John P. Morton & Co., publishers, Louisville, Ky.

CLEVELAND DENTAL ASSOCIATION held its annual meeting Dec. 7, 1903, and elected the following officers: President, J. W. McDill; Vice-president, George M. Wasser; Recording Secretary, M. C. Ramaley; Corresponding Secretary, Henry Barres; Treasurer, D. A. Zigler.

ILLEGAL PRACTITIONERS,—Dec. 3 a man was arrested at San Francisco for practising dentistry without a license.—Dec. 18 a man in Brooklyn was fined \$50 for failure to have a license.—Dec. 9 two men were arrested at Rochester for practising dentistry without a license.

St. Louis Dental Society held its annual meeting Dec. 2, 1903, and elected the following officers: President, Herman Prinz; Vice-president, C. DeWitt Lukens; Secretary, J. F. Austin; Treasurer, J. G. Pfaff; Corresponding Secretary, DeCourcey Lindsley; Librarian, W. A. Roddy.

COFFEE AND PYORRHEA ALVEOLARIS.—J. B. Ensmere, Cosmos. The use of coffee hinders the elimination of tissue waste and is therefore injurious in the presence of gout and rheumatism. It should be forbidden by the dentist to the patient whom he is treating for pyorrhea alveolaris.

AMERICAN ACADEMY OF DENTAL SCIENCE held its annual meeting at Boston Dec. 2, 1903, and elected the following officers: Pres., F. G. Eddy; V.-P., Wm. H. Potter; Rec. Secy., W. E. Decker; Cor. Secy., F. E. Banfield; Treas., J. R. Piper; Librarian, E. C. Blaisdell; Editor, H. S. Parsons.

QUONEHTACUT DENTAL CLUB held its annual meeting at Hartford, Conn., Dec. 11, 1903, and the following officers were elected: President, A. C. Fones; Vice-president, G. O. McLean; Secretary and Treasurer, Charles

McManus; Council, C. W. Strang, James McManus, E. S. Gaylord, A. C. Fones.

Fraternal Dental Society of St. Louis held its annual meeting Dec. 8, 1903, and elected the following officers: Pres., E. E. Haverstick; V.-P., W. E. Brown; Rec. Secy., E. P. Dameron; Cor. Secy., J. E. Todd; Treas., S. T. Bassett; Exec. Com., B. L. Thorpe, W. L. Whipple, G. H. Mathae.

RAPID GRANULATION OF WOUNDS EXPOSED TO SUNLIGHT.—O. Bernhard has been making a practice lately of exposing slowly-healing wounds to intense sunlight. Granulation is visibly promoted and the healing of tuberculous cavities after evacuation has been favorably influenced.—Corr. f. Schw. Aerz.

ACIDS WHICH BRING ABOUT EROSION OF ENAMEL.—W. H. Reaben, Head-light. Enamel suffers from chemical solution through the action of acids formed in the mouth during fermentative processes, and probably by morbid secretions of the glands, also through the action of acids present in foods or taken as medicinal agents.

To PREVENT FRACTURE OF RUBBER PLATE.—When gum sections are used, to prevent fracture at the median line or opening of the joint after the wax has been mashed out, pass a loop of fine platinum wire around the pins on either side of the joint between the two central blocks; twist the ends of the wire together, flask, and vulcanize.—Hints.

Indianapolis (Ind.) Dental Society was organized Dec. 8, 1903, and the following officers were elected: President, W. A. Heckard; Vice-president, C. E. Worth; Secretary, C. A. Barnhill; Treasurer, J. A. Johnson; Roard of Censors, C. C. Miller, H. Thompson, J. Goode; Board of Directors, H. A. Sampsell, D. L. Stine, A. F. Steinheiser.

Morphin to Lessen Shock Following Hemorrhage, Burns, Etc.—After severe hemorrhage, burns, or lacerated wounds, the prompt use of moderate doses of morphin is of extreme value in diminishing pain and lessening the shock. By quieting the restlessness and slowing the heart's action it is also apt to lessen hemorrhage.—Inter. Jour. of Surg.

FILLING ROOT-CANALS IN DECIDUOUS TEETH.—H. W. Gillette, *Items*. I have found much satisfaction from simply stuffing the canals with a mixture of vaselin and iodoform, mixed stiff, getting it to the end if possible, but as far in as I can, covering it usually first with gutta-percha and then with whatever material is chosen for filling the cavity.

LUZERNE AND LACKAWANNA (PA.) DENTAL SOCIETY held its annual meeting at Wilkesbarre, Dec. 15, and elected the following officers: President, C. C. Laubach, Scranton; Vice-president, R. S. Meixell, Wilkesbarre; Recording Secretary, E. M. Green, Scranton; Corresponding Secretary, C. H. Totten, Wilkesbarre; Treasurer, George Knox, Scranton.

AND HE WONDERS WHY.

He swiftly gulps his coffee down
And bolts a piece of pie;

He gets the indigestion
And says he wonders why.—Alk. Clinic.

A LITTLE More of the SAME.—Lawyer: "You say that you were in the saloon at the time of the assault referred to in the complaint?"

Witness: "I was, sir."

Lawyer: "Did you take cognizance of the barkeeper at the time?"

Witness: "I don't know what he called it, but I took what the rest did."

Kansas City Association of Licensed Dentists was organized at Kansas City, Mo., Dec. 1, 1903, and the following officers were elected: President, H. S. Vaughn; Vice-president, Herbert Huttman; Secretary and Treasurer, F. W. Franklin. The main object of the organization is to check the illegal practitioners who are said to be numerous in that city.

APPLICANT'S RIGHT TO EXAMINE PAPERS.—The city solicitor of Washington, D. C., has, in an opinion given to the Board of Medical Supervisors, decided that an unsuccessful applicant for license to practice medicine has the right to inspect his papers afterward. The decision was the result of the refusal of the board to permit such inspection by a rejected candidate.

ANESTHESIA AND ALCOHOLICS.—In operations on alcoholic subjects it is often wise to give them a drink of spirits an hour or less before its performance. These people are more restless than others and often require a greater quantity of the anesthetic to abolish sensibility, but long deprivation of drink tends only to intensify those unfavorable tendencies.—Inter. Jour. of Surg.

Polishing of Crown's Without Spoiling Their Shape.—O. H. Simpson, Summary. Fill about half full of softened sealing-wax, insert a stick for a handle, and allow to cool. The crown can now be polished without stretching the neck. Remove the crown by holding it in a flame, allowing it to drop off. Burn wax in crown by holding in the flame, and afterward drop in a pickle.

McLean County (Ill.) Dental Society held its annual meeting at Bloomington, Nov. 19, and the following officers were elected: President, G. D. Sitherwood; Vice-president, J. W. Keener; Secretary, B. M. Vandervoort; Treasurer, J. W. Brown; Executive Committee, S. Reece, O. J. Jarrett, H. C. Rodenhauser; Board of Censors, J. A. Campbell, D. M. Field, P. H. Geiger.

QUEER ADVERTISEMENTS.—An itinerant dentist in a western town recently put up a sign which read "2th pullin'."—An individual in a Wisconsin town advertises to be "the only dentist in the city that fills teeth by the new process of mummifictation, one sitting all that is required. Old ulserated decayed and painful teeth relieved in twenty minutes without the use of the socalled air of gas."

DIVORCES.—The wife of B. L. Conway, a dentist at Wilmington, O., has brought suit for divorce.—Helen P. Johnson has brought suit for divorce against her husband, a dentist of New York City.—Mary R. Lake has had her husband, Charles R. Lake, a dentist of Detroit, arrested on a charge of nonsupport.—Delia Mitchell has brought suit for divorce against her husband, W. W. Mitchell, a dentist of Anderson, Ind.

PYORRHEA ALVEOLARIS A CATARRH OF THE GUMS.-Fisher in Items. In

the case of a patient whose gums showed every evidence of Riggs' disease, the effects in the mouth of the use of Seiler's antiseptic tablets for the nose and throat were most remarkable. Instead of loose teeth and spongy gums the teeth became firm and the gums perfectly healthy in a short time. Since that time I have treated several other cases and I believe that a good many that we treat for Riggs' disease have a form of catarrh of the gums.

ARTIFICIAL SINUS.—Brackett in International. To shorten the period of suffering in forming abscess, when the canals are permanently filled, benumb the gum overlying the affected root with cocain. Heat a small bur sufficiently to make actual cautery and plunge it through the gum, and with engine drill or bur perforate the alveolar wall to the apex of the root. The cocain makes it almost painless; there is no burn. You see the bare process at the bottom of the opening in the gum and can direct the drill by sight.

CURE FOR RED NOSES.—A Berlin physician, says *Phila. Med. Jour.*, probably a sufferer himself, has announced that a tendency to redness of the nose, due to fugitive erythema, either from internal or external causes may be cured by benzine applications. He applies the benzine on a folded piece of lint, kept upon the erythematous area a few seconds without causing friction. When this is repeated a few times the skin covering the nose becomes paler and less shiny. Applications of benzine may also be made prophylactically.

BANKRUPT.—S. W. Dennis, a dentist of San Francisco, filed a petition in bankruptcy Dec. 7, listing his debts at \$11,651 and his assets at \$325.—Wm. E. Goucher, a dentist at Jamestown, N. Y., filed a petition in bankruptcy Dec. 4, giving his liabilities at \$5,340 and his assets at nothing.—J. Helyer, a dentist at Trenton, N. J., filed a voluntary petition in bankruptcy Nov. 24, listing his liabilities at \$69,743 and his assets at \$14,000.—J. A. Stockwell, a dentist at Boston, filed a petition in bankruptcy Dec. 15, stating that he owed \$522 and had no assets.

GELATIN AS A HEMOSTATIC.—In a previous issue (Merck's Archives), we showed that it was known as such more than a century ago. Dr. Y. Miva, a Japanese physician, now claims that the hemostatic properties of gelatin were known and made use of by the Chinese more than 1,600 years ago. Mention of the subject is to be found both in Chinese and Japanese literature. The gelatin was prepared from the hides of cattle, and was applied to the bleeding part in the form of a solution or a powder. It was employed in nasal, dental, urethral, uterine, and rectal hemorrhages.

Buttons for False Teeth.—It is reported that a rich but penurious old woman in Pittsfield, Mass., recently performed some homemade dentistry. Some years ago she began wearing a gold plate carrying the posterior teeth. She demurred at the dentist's bill, but finally paid it. She has been gradually losing her front teeth, and rather than pay for a new plate she punched holes in the front of the old plate and sewed on ivory buttons with strong linen thread. A dentist offered to make her a new plate if she would give him the old one, and on examination he found that her substitute had been fairly efficient, the buttons being considerably worn.

Examining Board Affairs.—The Supreme Court of Colorado on Dec. 5 handed down an opinion declaring the state dental law constitutional. A man practising without a license was recently arrested by the state board, and at once started a fight against the law. He was defeated in the lower court and the Supreme Court decided against him in its opinion.—At the last meeting of the Massachusetts Board 32 out of 75 applicants were successful in passing the examination.—At the last meeting of the Ohio Board nine out of 20 applicants were successful. A man at Columbus has brought a mandamus suit against the board to compel them to give him a license without examination.

How to Remove Rust from Polished Steel.—To remove rust from polished steel potassium cyanid is excellent. Soak, if possible, the instrument to be cleansed in a solution of potassium cyanid in the proportion of one ounce of cyanid to four ounces of water. Allow this to act till all loose rust is removed and then polish with cyanid soap. The latter is made as follows: Potassium cyanid, precipitated chalk, white Castile soap. Make a saturated solution of the cyanid and add chalk sufficient to make a creamy paste. Add the soap cut in fine shavings, and thoroughly incorporate in a mortar. When the mixture is stiff cease to add the soap. It should be remembered that potassium cyanid is a virulent poison.—Power and Transmission.

SELFISH INVALIDS.—Dr. S. Weir Mitchell says—"In all my experience as a physician I have not seen more than a dozen men or women who have been improved morally by long-continued suffering. Acute illness and illness which brings the patient close to death often has a beneficial effect upon the disposition, but I cannot agree with the assertion which we frequently hear made in the pulpit that suffering is usually the means of refining. I have seen a few isolated cases in which this was so, but it is not the rule by any means. The chronic invalid is almost invariably selfish and peevish, and it is a hard task to find a nurse who can stand the strain of such a service."

Dentist Outwits Swindler.—A dentist in New England was recently visited by an individual representing a collection agency of New York City. Upon his representations the dentist gave him a lot of old accounts for collection and was asked to sign a contract in duplicate. He read the original and then signed both. The eagerness with which the agent picked them up made him suspicious, so he demanded to see the contracts again and they were unwillingly given to him. He found that the supposed duplicate contained a clause not in the original which would have caused loss to him. He tore up the papers and ordered the agent out of his office. Later the fellow returned complaining of toothache and indicated the one he wanted extracted. This being a perfectly sound tooth the dentist scented a damage suit and refused to extract it. He then kicked the agent out.

FIRES.—C. A. Bean, Batavia, N. Y., Nov. 20, nominal loss.—H. J. Burkhart, Batavia, N. Y., Nov. 20, loss \$100.—A. C. Baxter, Randsburg, Cal., Nov. 13, loss \$300.—F. H. Darragh, Beaver Falls, Pa., Dec. 12, loss \$100. fully insured.—J. DeCouagne, Fall River, Mass., Dec. 11, loss \$400.—A.

Dewhirst, Middleport, N. Y., Nov. 26, loss \$300.—W. I. Freeman, Auburn, Ky., Dec. 6, loss \$300.—E. A. Freeman, Lawrence, Mass., Dec. 5, loss \$200.—R. E. Goodhouse, Randolph, Wis., Dec. 13, loss \$400.—F. O. Kidd, Fall River, Mass., Dec. 6, loss \$100.—B. H. Reid, Anderson, Ind., Dec. 6, loss \$200.—Edward Schrantz, St. Louis, Dec. 17, loss \$1,000.—W. O. West, New Orleans, Nov. 16, loss \$300.—Wright & Shewmake, Monticello, Ark., Dec. 3, loss \$150.—C. C. Woolard, Pulaski, Tenn., Dec. 1, loss \$400, fully insured.—E. H. Weber, Lake Mills, Wis., Dec. 18, loss \$200, partially insured.

Broken Bone Revealed by X-Rays.—(Reported to Rochester (N. Y.) Dental Society by Dr. B. J. Saunders.)—A young man presented who had had a bad fall while playing polo. I had been treating his upper jaw, supporting his teeth with Richmond crowns, etc. Upon examination I found that the superior maxillary was badly fractured, projecting down and outward in front, so I set the parts and splinted the jaw and teeth. He did not call again for some time, and when I removed the splint I found that the left lateral incisor was loose, with a large amount of pus oozing from it. The tooth felt so loose that it was a question whether it had been fractured perhaps two-thirds of the way up or was entirely loose in the socket. On having a skiagraph made, however, I found that a splinter of bone was lying alongside the tooth and was causing the whole trouble. I removed same, ligatured the tooth, and it soon became perfectly firm.

BLACKHEADS.—"To the Editor: I have just reached the age of seventeen, and although shy and sensitive, have been keeping steady company four months, come next Saturday night. What I desire to ask you in confidence is, can you give me a positive cure for blackheads? I have them good and plenty, and it is very embarrassing, as I feel when Percy is talking to me that he is not looking at me but at my blackheads. Please tell me what to do and you will always have my warmest gratitude.—Gladys."

We know all about blackheads, as they used to run in the family. A good temporary remedy is to remove them with an apple corer or a butter tester, but unless the tails are removed they will grow again. Blackheads, as a matter of fact, are caused by an excess of ink in one's system, and the only way to effect a permanent cure is by the blotter treatment, the directions being one ordinary blotter of commerce after each meal. Keep them by the side of your typewriter and you won't forget them. Swallow them dry, washing down with a little lake water—boiled.—Ex.

ROBBERIES.—C. F. Jarvis, Oakland, Cal., Nov. 28, \$50.—E. R. Tait, Oakland, Cal., Nov. 28, \$55.—R. W. Henderson, Stockton, Cal., Nov. 30, \$40.—Dr. W. R. Heacock, Redlands, Cal., Dec. 6, \$100.—A burglar attempted to blow up the safe in the office of Bush & Sons, San Francisco, Dec. 8, but was frightened away.—N. B. Glasgow, San Bernardino, Cal., Dec. 6, \$40.—J. W. Neblett, Riverside, Cal., Dec. 5, \$35.—C. W. Packard, Riverside, Cal., Dec. 6, \$50.—M. E. Tabor, Riverside, Cal., Dec. 6, \$40.—Thos B. Waterbury, Brooklyn, Nov. 25, \$60.—Hoose Dental Co., Amsterdam, N. Y., Nov. 24, \$300.—J. P. Taggert, Canton, O., Dec. 10, \$25. In this case the thief was caught.—

C. F. Rodgers, Conneaut, O., Nov. 22, \$10.—J. H. Abbott, Philadelphia, Nov. 11, \$148. The thief was caught.—J. A. Rupert, Meadville, Pa., Dec. 1, \$50.—Nov. 27 a burglar was caught in a dentist's office at Pittsburg.—Alfred Cook, Salt Lake City, Nov. 23, \$100. The thieves were caught.—J. D. Ennes, Norfolk, Va., Dec. 3, \$100. The doctor has offered a reward for the apprehension of the thief, and has published the fact that a trap gun will greet the next invader.

To SET A CROWN OR BRIDGE WITH GUTTA-PERCHA.-G. D. Sitherwood in Review. Put about an inch square of ordinary pink gutta-percha in a small porcelain butter dish, and pour half a dram of chloroform on it. Have everything clean and dry. With a small spatula scrape enough softened gutta-percha to perfectly cover the inside of your crowns and pins. In a few minutes the chloroform will evaporate sufficiently so you can heat on your electric or mica gold annealer, and try on in the usual way with the roots of teeth wet so the gutta-percha will not stick. If not enough guttapercha, dry with spunk and add a little more, if too much take off a little. When just right, dry your roots thoroughly with whatever method you are familiar. Heat your crown or bridge hot on the annealer, have a heavy kid glove on your right hand, pick up the crown or bridge with the gloved hand, and place it quickly and firmly in position, using whatever method you are accustomed to in driving home, only taking care that it is not too hot, and that you have properly protected the tongue and lips with a napkin. Do not use the same piece of gutta-percha twice, but always take a new one.

ACCIDENTS.-W. F. Buchanan, a dentist in Washington, was badly burned Nov. 20 by the explosion of a vulcanizer.-F. Kegey, a dentist at San Pedro, Cal., was burned Dec. 3 by the explosion of a gasoline stove.—Dec. 17 a vulcanizer exploded in the office of L. E. Ireland, a Chicago dentist, severely injured his assistant, and wrecked the furniture.-A young woman at Arcola, Ill., while in a dentist's chair Dec. 7, collapsed and was revived with difficulty.—A vulcanizer exploded in the office of the Stempel Dental Co., at Ft. Madison, Ia., Dec. 7, and damaged the building.-Hugh Garrett, a dentist at Coldwater, La., was severely burned Dec. 8 by the explosion of a vulcanizer.—Last month a man at Buffalo swallowed a plate carrying two teeth. It was located by the X-ray, the stomach was cut open and the plate removed. The patient is doing well.—Dec. I a dentist at Cincinnati broke a man's jaw while extracting some teeth.-A dentist at Milwaukee recently gave one of his patients, a judge, a bottle of ammonia instead of a mouth wash. The judge used it before he discovered the mistake, and lost his voice to such an extent that he had to adjourn court in the middle of the session. Unless that dentist is careful he will be fined for contempt of court.

CHLOROFORM LINIMENT FOR DENTAL USE .- W. H. Trueman, International.

Chloroform, 3ii; Ether, 3ii; Alcohol, 3i; Gum-camphor, 3i.

This is a valuable preparation and should be kept handy in every dental effice. A large pledget of cotton, saturated with it and placed on the gum

over a painful tooth, usually gives prompt relief. It is especially useful in painful conditions following an arsenical application, pulp-canal filling, the insertion of a crown or bridge, and the after-pain of tooth-extraction. It usually mitigates very much the pain attending an alveolar abscess, and is a comfort to the patient if used before beginning the preparation of a root for crowning. Its efficiency is increased by adding a small portion of chloretone immediately before making the application. With the addition of a very little formaldehyde and chloretone or cocain it may be used to anesthetize a pulp preparatory to its extirpation. When applied to the gums the first effect is usually a sharp and rather severe smarting, which passes off in a minute or two.

THE RELIABLE PRESS.—"Miss —— has entered suit against Dr. ——for \$50,000 damages. She alleges that he was called to her home to attend her, and that he carelessly and negligently treated her, and then abandoned her while she was suffering great agony to catch a car."—Pittsburg Dispatch. We wonder if she caught the car.

"Mr. Blank is manufacturing an aluminum surgeon's chair that is meeting with great sales."—Greenup (Ill.) Press. This is probably intended for surgeons of mettle.

"Tuberculosis of the lungs carried off twenty-five victims last month. Seven others died of tuberculosis and four of phthisis."—Los Angeles Express. A fine distinction.

"We are glad to state that Mrs. Beulah Hutchison is improving slowly. She has been confined to her room for eight weeks with Dr. Walker her attending physician."—Columbia (Tenn.) Democrat.

"Dr. —— died last night. For many years he was one of the leading butchers of Huntsville, but retired some time ago."—Huntsville (Ala.) Mercury. Was he a surgeon?

Dental College Graduates.—We give herewith a list of the number of graduates in 1903—Atlanta Dental College, 46; Baltimore College of Dental Surgery, 57; Baltimore Medical College, 23; Birmingham Dental College, 4; Central Indiana Dental College, 4; Chicago College of Dental Surgery, 167; Cincinnati College of Dental Surgery, 15; Colorado College of Dental Surgery, 19; Columbian University, 7; Des Moines College of Dental Surgery, 19; Detroit College of Medicine, 46; Harvard University, 27; Howard University, 9; Indiana Dental College, 65; Kansas City Dental College, 28; Keokuk Dental College, 19; Lincoln Dental College, 9; Louisville College of Dental Surgery, 65; Marion-Sims Dental College, 39; Medico-Chirurgical College, 24; Meharry Medical College, 5; Michigan University, 81; Milwaukee Medical College, 32; Missouri Dental College, 30; National University, 8; New Orleans College of Dentistry, 15; New York College of Dentistry, 54; New York Dental School, 12; North Pacific Dental College, 23; Northwestern University, 175; Ohio College of Dental

Surgery, 81; Ohio Medical University, 62; Pennsylvania College of Dental Surgery, 80; Philadelphia Dental College, 120; Richmond University, 10; Royal College of Dental Surgeons, 54; San Francisco College of Physicians and Surgeons, 22; San Francisco Dental College, 4; Southern Dental College, 32; Tuft's College, 48; University of Buffalo, 75; University of California, 43; University of Southern California, 16; University of Illinois, 40; University of Iowa, 32; University of Maryland, 64; University of Minnesota, 34; University of Omaha, 32; University of Pennsylvania, 102; University of Tennessee, 16; Vanderbilt University, 18; Western Dental College, 60; Western Pennsylvania University, 57; Western Reserve University, 40; Wisconsin College of Physicians and Surgeons, 6. Total, 2,295.

MARRIAGES .- A. G. Able, a dentist of Easton, Pa., was married to Miss Minette Lynn of Easton, Nov. 17.—Arthur Ellis, a dentist of Pasadena, Cal., was married to Miss Ella Hain of Los Angeles, Nov. 10.-V. A. Goodrich, a dentist of San Pedro, Cal., was married to Miss Mattie H. Loutz of Grand Rapids, Mich., Dec. 8.-H. A. Gordon, a dentist of Nashua, N. H., was married to Miss Nina C. Holt of Nashua, Dec. 16 .- W. L. Jones, a dentist of Pratt City, Ala., was married to Miss Mittie Taylor of Hucklebee, Ala., Nov. 19.-F. O. Kidd, a dentist of Terre Haute, Ind., was married to Miss Stella Holabaugh of Terre Haute, Dec. 16.-W. M. Labelle, a dentist of Holvoke, Mass., was married to Miss Elizabeth Maher of Holvoke, Dec. 2.— O. G. Lochman, a dentist of Los Angeles, was married to Miss Alice Killian of Los Angeles, Dec. 2.—George E. Mason, a dentist of Milwaukee, was married to Miss Luella H. Lockwood of Racine, Wis., Dec. 17.-R. T. Neer, a dentist of Gallatin, Tenn., was married to Miss Lillian White of Columbus, O., Nov. 25 .- H. C. Olson, a dentist of Rich Hill, Mo., was married to Miss Blanch Lindsey of Kansas City, Nov. 15 .- A. W. Pounder, a dentist of Elkhart, Ind., was married to Miss Ethel Wagner of Elkhart, Dec. 2.—George E. Palmer, a dentist of Keokuk, Ia., was married to Miss Sadie Celleyhan of Keokuk, Nov. 25.-J. W. Rawlings, a dentist of Tacoma, Wash., was married to Miss Jennie M. Bell of Tacoma, Dec. 9.-D. H. Ross, a dentist of Reno, Nev., was married to Miss Bertha Gardner of San Francisco, Dec. 25.-R. H. Reed, a dentist of Jacksonville, Ill., was married to Miss Dolly Burneson of Peoria, Dec. 10.-A. L. Revell, a dentist of Lead, S. D., was married to Miss Margaret O'Donnell of Deadwood, Dec. 10.-H. A. Stevenson, a dentist of Bloomington, was married to Miss Bessie Covkendal of St. Paul, Dec. 2.—C. L. Stapleton, a dentist of Medora, Ill., was married to Miss Dora A. Wassom of Chrisman, Ill., Nov. 25.

GERMANY PUNISHES QUACKS.—A medical charlatan at Hanover acquired the title of professor of music from some Italian school of music, and paraded this title of professor in all his advertisements and on his signs. The court fined him for using the title of professor as intended to deceive in regard to his medical standing.

The Medical Chamber at Berlin recently secured the condemnation of a charlatan in another town for unwarranted claims in his advertisements. He published among others a certain signed testimonial from a person cured of pulmonary tuberculosis in four months by his remedies. The case was

investigated by a committee from the chamber and the claim shown to be false. The affection was an apical catarrh and had not been entirely cured, while the statements in regard to previous medical treatment were false. A fine of \$75 was imposed by the court.

A new daily paper has been founded in Vienna, and the managers announce that no advertisements will be received that conflict with medical standards. They have appealed to the local medical chamber for guidance.

The Magdeburg Medical Society has been energetically at work trying to curb quack practices in that city, and the advertisements of charlatans have become much more moderate in tone, the writers now taking pains to avoid conflicting with police regulations. The editors of the journals publishing the extravagant claims of the charlatans are made parties to a suit when such is brought. According to the German law a charlatan is liable to prosecution if his promises to cure the patient delude the latter until the time is past when scientific or surgical aid might have been effective. What a pity that the republic of the United States cannot enact such effective laws as does the monarchy of Germany, and that our professional men do not take the same interest in repressing quackery as do those of the latter country.

THE VERY FIRST YEAR HE'S OUT.
What an opulent thing
Is the medical king;
How proudly he wanders about!
Far richer is he
Than again he will be;
It's the very first year he is out.

If we ask him by chance
Of his practice expanse,
He will tell us with smile that is bland
Of the way he is run
From sun until sun,
How his praises are sung in the land.

Of the laps he's done,
Of the races he's won
With the ghastly old angel of death;
Of the cases in which,
For the famous and rich,
He has given back heart-beat and breath.

And he does not admit
That at noon he must sit
On a stool at a counter at lunch;
That sinkers and tea
The viands must be,
That this medical kinglet must munch.

-G. T. P., in Chicago Clinic.

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VOL. IX.

DECEMBER, 1903.

No. 12.

The

Dental Digest

A MONTHLY SUMMARY OF DENTAL SCIENCE DEVOTED TO THE PROGRESS OF DENTISTRY.

THE OFFICIAL ORGAN OF THE

National Dental Association, Southern Branch National Dental Association, National Association Dental Examiners.

Pennsylvania State Dental Society, Illinois State Dental Society, Dental Protective Association. Wisconsin State Dental Society. Nebraska State Dental Society, Rochester Dental Society,

Michigan State Dental Association, Kentucky State Dental Association, Cincinnati Odontological Society, Northern Ohio Dental Society, Etc.

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Resteres normal conditions and maintains perfect

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210 Fulton St. - New York





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and is very efficient in the treatment of all the advanced stages of the disease. A mild tonic and stimulant; an antacid, antiseptic, deodoriser and disinfectant. A perfect mouth wash.

We received in 1900 over 6,000 requests for samples.

A Pertect Dentifrice.

Pres from all objections. Recommended by

Contains no acid, soap, potash, charcoal, suttle-bone, pumice-stone, or any other harm and injurious ingredients which scratch, wear, deface the fillings, discolor the teeth and arritate the gums.

Samples for distribution and powder for personal use upon request, prepaid.

DR. E. L. GRAVES TOOTH POWDER CO.,

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The Best Antiseptic for a Dentist's Prescription

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Listerine exercises an inhibitory action upon the acid-forming bacteria of the mouth, and thus maintains the alkaline condition so necessary for the welfare of the teeth.

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FOR THE TEETH

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CONTAINS
Salitrol
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Majorum
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Recognized and Endorsed as the Most Efficient Dental Products in Use

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FIRST AID TO THE DENTIST.



Dioxogen H2 O2 3%

ANTISEPTIC DEODORIZER

DISINFECTANT STYPTIC

A necessity in operative and surgical work.

Destroys pus and the products of decay and fermentation.

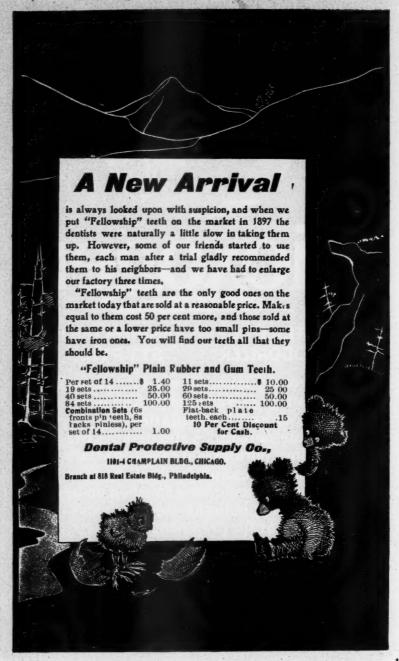
Cleans out cavities and destroys bad odors purifies and cleanses bridgework plates and artificial dentures.

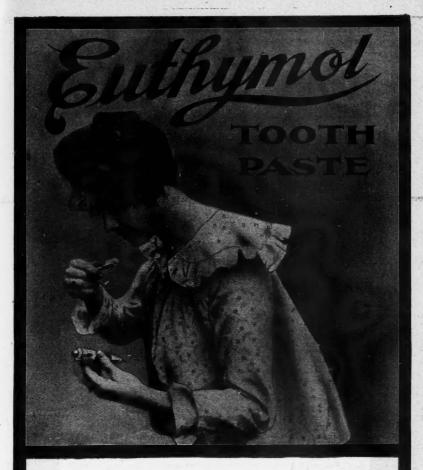
A positive tonic for weakened tissues reducing irritation and soreness.

Excellent for preparing sensitive mouths and teeth for treatment.

HARMLESS

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Euthymol Tooth Paste meets this want. It cleanses the teeth effectually. It prevents discoloration and decay. It projects the mouth from germ contamination. It gives to the breath a pleasing fragrance. Use it, and recommend it to your patients.

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"Fellowship" burs cut faster and cleaner, and hold their edges longer than any others. This is due to the fact that the twin or "dual" blades traverse the entire cutting surface, and these burs clear themselves when in use. They shave and do not grind the dentin, so are a comfort to the operator and a relief to the patient.

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sample dozen will wed you to these instruments.

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Made in all sizes and shapes, for universal and angular handpieces.

Dental Protective Supply Co.

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that she can't-her lips are sealed with a material closely resembling "Fellowship" cement.

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(SEE AD PAGE 18 FOR DETAILS.)

Buying A Pig In A Poke

is what most dentists do when they buy rubber dam, as the size and price of the roll vary according to the disposition of the supply house. You can effect a great saving on your dam in the course of a year by always ordering it by the yard and occasionally measuring the yard.

There are no "short" rolls in our stock.

Every yard we sell is 6 inches wide and 18 feet long, or 5 inches wide and 21 3-5 feet long, and contains a

FULL SQUARE YARD.

EVERY ROLL WARRANTED.

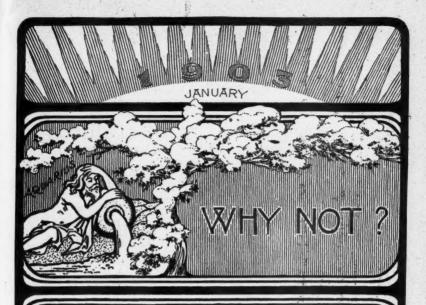
Your money back if it is not just as good or better than what you have been using.

Medium Dam, \$1.25 for a full square yard.
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START the New Year with instruments as good as new. Let us help you to do so. Our business in repairs has steadily grown until we are now satisfying thousands of dentists. Are you among that number? If not, a trial will put you there. We guarantee satisfaction or money back.

PER DOZ.	PER DOZ.
Cavity Burs, Recut and Stoned \$0.50	Finishing Burs, Recut and Stoned, \$1.00
In six dozen lots	Fxcavators Repointed75c to 1.00
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Mirrors Reglassed, o	each\$0.30

NICKEL-PLATING DONE AT REASONABLE RATES.

Being manufacturers of Handpieces, we are equipped to make a specialty of Handpiece Repairing.

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MOUTH MIRRORS

Perhaps no other instrument is used more constantly than the Mouth Mirrer. It is therefore necessary that this instrument should be always of the very best workmanshlp. Two or three points of superiority distinguish our product from the general run. In the first place, the glass for the lenses is selected with great care. Our Mirrors are mounted carefully in their frames, and so far as possible they are asseptic.

Instead of the old-time way of cutting a thread upon the handle, rendering the mirror extremely delicate at the point of greatest strain, our mirrors have a stiff metal rod inserted in their handles. That's why our Mirrors never break.

Finally, the price is lower than those of inferior make.

DENTAL PROTECTIVE SUPPLY CO.

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Require considerable oil, so do handpieces.

The automobilist expects to get oil and grease on his clothes and hands, so he wears leather gloves, leather cap, coat, etc. The dentist gets the oil, whether he expects it or not, but he can't very well wear leather gauntlets, nor can his patients wear leather face guards.

The automobile weighs a ton—the handpiece three ounces, but some handpieces throw off as much oil and smell as bad as an automobile.

The "Fellowship" handplece does not smear oil, and it has several other good qualities. There is not a screw in it, so it can be easily taken apart to oil and clean without wrench or screw-driver. It has long, efficient cone bearings, and we guarantee that if kept well oiled and cleaned the handplece will outlast any other. The wear can be readily taken up from time to time; if repairs should be necessary, their cost, owing to its simple construction, will be about half as much as for other handpleces. It can be attached to any engine or slip-joint, will hold all burs except the "No. 6," and any angle attachment may be used with it.

PRICE, \$10.00.

Just to introduce the "FELLOWSHIP" handpiece, we will allow \$2 for your old one, so it and \$8 (\$7.20 if cash accompanies order) will bring you an eminently satisfactory instrument. Don't be annoyed one day longer when such an offer as this is open to you.

DENTAL PROTECTIVE SUPPLY CO.

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CHICAGO.

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At present angular handpieces are not satisfactory; first, because the price is too high, and second, because they are continually breaking or getting out of order, thus causing frequent expense and trouble. The trouble has come from the fact that the proper combination of gears, which would give all the required angles and yet be strong enough to withstand the great strain, was not found. In our

"Fellowship" Angle Attachment and Angular Handpiece

we have solved the problem, and guarantee them to require less repair and to outwear any others on the market.

The Angle can be attached to our "Fellowship" Handpiece, or to the "No. 6" or "No. 7"; and the Angular Handpiece can be used with our own or with any standard slip-joint.

The bur can be held at either an acute, right or obtuse angle, thus giving all desirable positions.



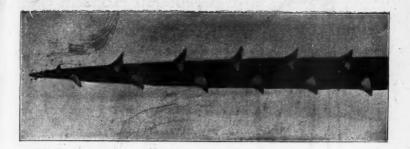
These instruments take a bur with groove in shank by which it is held. If you have a stock of "No. 2" angle or of Davis burs on hand, we will. without charge, fit them to our angle.

Angle Attachment, \$7.00 Angular Handplece, 7.50 Burs, per dozen,

Dental Protective Supply Co.

1101 Champlain Building, Chicago.

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This cut is made from a micro-photograph of a "FELLOWSHIP" BROACH, showing it enlarged about twenty-five times.

"Fellowship" Broaches are made from the finest spring-tempered steel and are barbed on three sides only, which makes them stronger and less liable to break than the Donaldson and similar broaches, which are barbed on four sides.

"Fellowship" Broaches are made by skilled workmen and every instrument is tested before leaving the factory.

"Fellowship" Broaches were the first of superior quality offered the dental profession at a reasonable price, and are now, as then, the peers of any broaches at any price.

Any supply house can make a fair profit retailing broaches at \$1.00 per dozen. We suggest that you ask the Trust houses why they have charged outrageous prices all these years.

"Fellowship" Broaches are put up in five styles—extra fine, fine, medium, coarse, assorted—and they sell for \$1.00 per dozen, \$5.50 per half gross, \$10.00 per gross.

Since we have made it possible for you to buy broaches at a reasonable figure, do we not merit your trade in this line? Insist on having "Fellowship" Broaches. If your dealer can't or won't supply you, send to us.

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It Is Not An Accident that the & &

"Fellowship" Engine

has every engine virtue and no engine faults. We make it so.

A new lot of 500 has just been completed, and in them a few improvements have been made, such as the dish-shaped wheel, etc., making this engine the most artistic and attractive in appearance of any. All points of possible weakness have been strengthened, so that breakage is almost impossible.

The drop pulley head has long bearings on either side of the wheel, which insure steady running and equal wear at all points.

A slight upward toss of the arm raises it into position, and pressure on the thumb-piece loosens it. This is the most convenient locking device on the market.

The standard can be raised or lowered by set screw.

Weight of driving wheel, 18 lbs.; diameter 12 in.

Every feature of the "Fellowship" engine is constructed upon correct mechanical principles, and it is the easiest running and most durable article of the kind yet offered to the profession.

Finally, the price is lower than that asked for inferior engines. We offer the "Fellowship" equipped with our universal handplece, 14 instruments, oil can, flexible sleeve and engine arm support for

\$37.00

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OF ALLOYS OF THAT CLASS IS

VCTILE

Do not use something which is no better now than it was thirty years ago. The alloy revolution came in 1897, and it was shown at that time that there was not one on the market fit to use.

There are to-day two kinds of alloys in use—one, quick setting, rich in silver—so hard-working and not plastic. In this class "Fellowship" stands supreme.

The other class comprises those alloys which are termed slow-setting, easy-working and plastic. Most of these latter are utterly unreliable, as they shrink badly and wear away rapidly.

We have, however, perfected an alloy in "Ductile" which does not have these faults. It amalgamates readily and works easily, sets slowly, does not shrink, resists the wear of mastication and retains a good color. We guarantee it to be superior to all other plastic alloys, and can heartily recommend its use to practitioners seeking this kind of a filling material. "Ductile" is not so good as "Fellowship," but it is far and away ahead of any other \$1.50 or \$2.00 alloy yet offered for sale.

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DUCTILE ALLOY

is \$1.50 per ounce.

Five ounces, . . \$ 7.00 Ten ounces, . 13.00

Twenty ounces, .



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Right Angle Mallet

Invented by DR. S. G. PERRY. New York

This mallet is one of the simplest, strongest and most attractive instruments for packing gold ever offered to the dental profession. The bearings are long and efficient, the hammer having bearings on either side. The plugger points are inserted without the use of special pliers or long tapers. and it merely requires a slight

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The rapidity of blow is regulated by the speed of the engine, and every revolution of the handpiece gives a blow.

The force of blow is regulated by the pressure brought to bear on the tooth..

The mallet can be attached to any handpiece.

Price of Right Angle Mallet, \$6.00

Price per set of six plugger points (assorted), \$2.00.

Dental Protective Supply Co.

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Four Points

wherein our "FELLOWSHIP" slip-joint is superior to all others:



First—It is universal and will fit any handpiece.



Second—The locking device is simplicity itself and there is no cumbersome catch to hinder and annoy you.

Third—It is cheaper. Price complete (parts A, B, C), \$6.50. Extra Sheath (A), 75 cents. Extra dog (C), 25 cents.



Fourth—It will last a lifetime, as the wear can be taken up. All other slip-joints might as well be thrown away when they start to wobble, but in ours the wear can be taken up. Notice the cone bearings at D, a feature possessed by ours alone.

DENTAL PROTECTIVE SUPPLY CO.

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A Good Cement Spatula

HAS PREVIOUSLY BEEN AN UNKNOWN QUANTITY.

As none was efficient and most of them corroded and discolored the cement. After several experiments Dr. Crouse has devised a spatula of specially tempered and treated steel, which is not affected by the cement acid, and will not discolor the mix. The shape is such as to guarantee thorough spatulation, which all cements require, "Fellowship" especially.

ACCURACY, CONVENIENCE AND

ACCURACY, CONVENIENCE AND ECONOMY

are effected by the dropper and tube which are supplied without eximal charge in every box of "Fellowship" cement. The dropper enables you to take out the liquid neatly and accurately, serves as a cork, and does away with the "smearing up" common to the handling of cement. The measuring tube enables you to obtain the exact proportions of powder for a given number of drops. Full directions with each package. There is absolutely no waste when these two conveniences are used, so your cement bill will not be more than half what it has been formerly.

"Fellowship" Cement is put up in five colors.

White, Light Yellow, Yellow, Light Pearl Gray, Pearl Gray, Blue Gray.

Other colors on demand.

Price, \$1.00 per box.
One liquid and one powder.

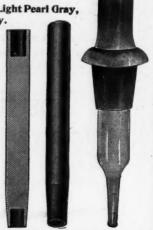
\$5.00 for 6 boxes.

Extra liquid or powder, each 50 cts.

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BRANCH: 818 Real Estate Bidg., Philadelphia.





when we perfected "Fellowship," the dentists of this country and Europe have had a thoroughly reliable alloy. Previous to that time there was not one on the market fit to put into the mouth, as the manufacturers did not care to incur the trouble and expense necessary to produce a reliable article. Consequently, conscientious dentists gave up the use of amalgam. "Fellowship," however, convinced them that there was such a thing as a trustweethy alloy.

"Fellowship," however, convinced them that there was such a thing as a trustworthy alloy.

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three rests from each batch, and guarantees it to be perfect before it leaves up factory.

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has all the good points possessed by others now on the market, and in addition has two special features peculiar to itself, namely,

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The spindle has cone journals, the right fixed, and the left movable, so that the wear may be readily taken up. There is a jamb nut to tighten the movable cone when properly adjusted, and to prevent it from coming loose.

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(Deutsche Zeitshrift f. Chirurgie, October, 1902.)

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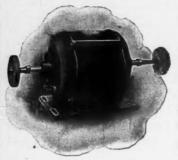
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Open the cavity freely so as to allow the rubber tip to be placed exactly over the area of exposure. 36 36 36

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Into this chamber a SMALL pellet of cotton is placed, saturated with the anaesthetic. Don't allow cotton to extend out over edges of the cup.

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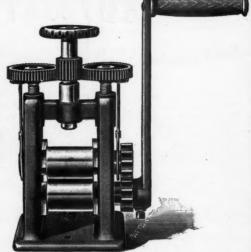
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20K Solder, per dwt		
Coin Solder, per dwt	1	00
22K Solder, per dwt	1	σο
18K Gold Plate, per dwt		85
20K Gold Plate, per dwt	-	95
22K Gold Plate, per dwt	1	05
24K Gold Plate, per dwt	1	10
Coin Plate, per dwt	1	02
Clasp Metal, per dwt		85
Clasp Wire, per dwt	1	00
Platinized Gold, per dwt	1	15
18K Gold Wire, per dwt		90
20K Gold Wire, per dwt	1	00
24K Gold Wire, per dwt	1	15
Platinum Sheet or Wire, per dwt	_	
Market	Pri	CA.
Platinum Iridio Wire, per dwt		
Market	Pri	00
Pure Silver, per oz\$		57
	v	0.
Columbian Alloy, \$2.00 per oz; 3	15	00
ozs. for	U	00
65 Silver, 35 Tin Formula, \$1.00 per oz.; 10 ozs. for	~	ro.
		50
Aluminum, per oz		10
German Silver Plate, per oz		10
Pure Zinc, per oz		10
Pure Tin, per oz		07
Pure Copper, per oz		05
Pure Bismuth, per oz		20
Broaches, per doz		00
Burs, per doz		75
Carborundum Strips, per box	-	85
Carborundum Disks, per box		08

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. 3	-Dark Orange	2.	75
4	-Dark Orange -Mottled Light Red)	2.	75
5	-Mottled (Dark Red)	2	75
6	-Maroon	2.	75
7.	Maroon	3.	
8	-Ordinary Black	2.	25
9	-Light Pink	5.	00
10	-Medium Pink	5.	
11	-Deep Pink	5.	00
12	-Brown	3.	00
13	-15 minutes for repairing	2.	25
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15	-Gutta Percha for Baseplate		
	-Gutta Percha Vulcanizable	3.	
17-	-Gutta Percha for Filling (per oz.).	1.	
18-	-Red Weighted	4.	00
19	-Black Weighted	4.	00
20	-White Rubber	5.	
	Gladiator	3.	00
	Anaconda	4.	00
	Rubber Dam (medium, per yard, in	-	-
	rolls 5 in. or 6 in. wide)	1.	50
	Rubber Dam (thin, per yard, in		
	rolls 5 in. or 6 in. wide)	1.	00
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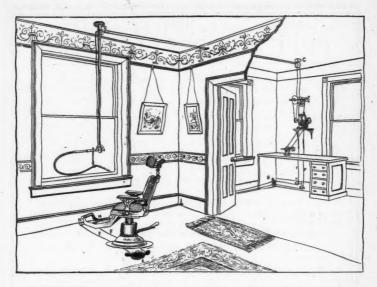
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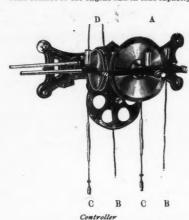
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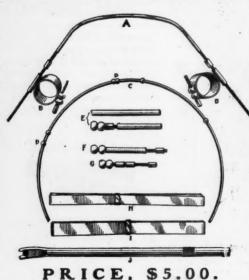
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The object of this invention is to facilitate the construction of Contour Inlays, and is of particular value for the anterior teeth, the angles of which have been lost through carles or traumatism.

The Advantages of the System Are:

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- 3. A considerable saving of time and trouble.

DR. JENKINS, of Dresden, than whom it will be freely conceded there is no greater living authority on the subject of inlays, has written us as follows:

"The Porcelain Cores you were so good as to send me, at the request of Mr. Mellersh, are excellent; please send me 500. I believe that so soon as the value of the invention is known there will be a very large demand for the Cores. There must be a great future for them. Combined with Porcelain Enamel, which is the strongest material of the kind ever discovered, it makes the most beautiful work, IMMENSELY STRONGER THAN CAN BE MADE WITH ANY HIGH FUSING PORCELAIN."

It is due to Dr. Jenkins that his invaluable assistance and advice should be recognized, and, therefore, we quote him thus largely; moreover, it will be an assurance to the profession that we have here an invention of the utmost importance, and that this view is not merely the assertion of the interested manufacturer, but is the opinion of the expert artistic worker.

To the practical inlay worker it hardly needs to be pointed out that the value of the invention lies primarily in the fact that in these Contour Inlay Cores a foundation is provided in which to build, and that the combination of Dr. Jenkins' Porcelain Enamel with the hard porcelain of the Core results in an inlay of UNSURPASSABLE STRENGTH, so that by this brilliant idea of Mr. Mellersh, Contour Inlay Work is greatly facilitated, and an inlay produced of greater strength and much sharper contour than is possible by any other method; moreover, the process effects a great saving of time.

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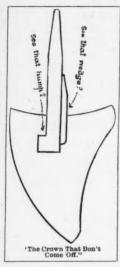
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It is made of best English porcelain, and has unsurpassed grinding and polishing qualities.
The post is removable, and out of the way while grinding for adaptation. Not having to grind around a fixed post, a more accurate fit can be secured in much less time than when a baked-in vest is used. post is used.

The metal wedge, by forcing the lug at bottom of post into the under-cut portion of the cavity,

locks the post securely in position, or the crown cannot possibly come off.

The front or back of the crown may be ground without danger of exposing the post and repolished

at will. The post is flat on all its sides, fits closely into a flat walled socket, and it is impossible for the crown to rotate on post.

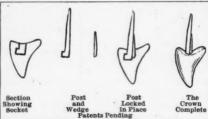
The close-fitting joint easily secured in the Haldeman crown requires but a very small amount of cement, thus reducing to a minimum the danger of disintegration from action of saliva

of disintegration from action of saliva.

The post may be soldered without destroying its strength, is small and strong, and not so likely to fracture small roots.

Should the crown be fractured it can be readily replaced without removing the post from the root. It is especially valuable in cases where Logan crowns have been fractured, and post left in root. By reshaping exposed part of Logan post to conform to shape of Haideman post, our crown can be easily placed in position on the Logan post without disturbing its seating in the root-canal. Send your name and address for special booksteon bridge work, which shows how bridge can be constructed so that each tooth is independent, and may be replaced in case of fracture without removing bridge from an and my be replaced in the case of fracture without removing bridge from an and my be replaced in the case of fracture without removing bridge from an and my be replaced for the case of fracture without removing bridge from an and my be replaced in the case of fracture without removing bridge from an and my be replaced for the case of fracture without removing bridge from an and my be replaced for the case of fracture without removing bridge from an and my be replaced for the case of fracture without removing bridge from an and my be replaced for the case of fracture without removing bridge from an and my be replaced for the case of fracture without removing bridge from an and my be replaced for the case of fracture without removing bridge for an and my be replaced for the case of fracture without removing bridge for an and my be replaced for the case of fracture without removing bridge for an and my be replaced for the case of fracture without removing bridge for an and my be replaced for the case of fracture without removing bridge for an and my be replaced for the case of fracture without removing bridge for an and my be replaced for the case of fracture without removing bridge for an an and and and the case of fracture without the case of fracture without the ca

removing bridge from anchorages. No exposure of porcelain to heat, when making Haldeman bridge.



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Fig. I. At birth Fig. 2. Age q.me. Fig. 3. Age Iyr. Fig. 4. Age I I-2yrs. Fig. 5. Age 3 I-2yrs.



Fig. 6. Age byears



Fig. 7. Age b years



Fig. 8. Age 7 years



Fig. 9. Age II Jears

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Fig. 10. Age 13 years



Fig. 27. Adults. Process and part of root cut away, exposing pulp canals



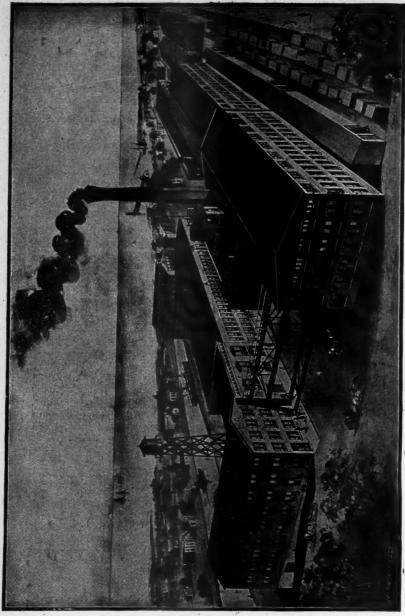
Fig 12. Old Age

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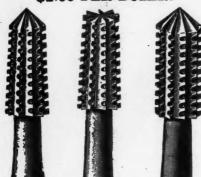
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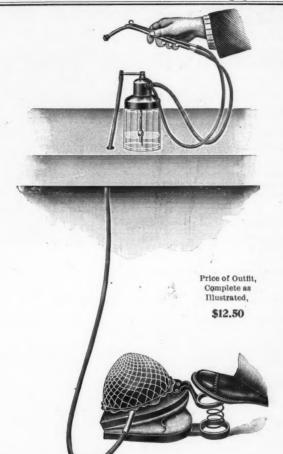
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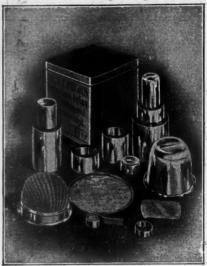
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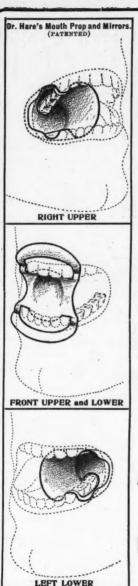
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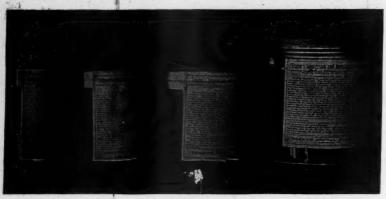


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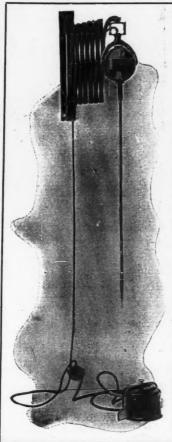
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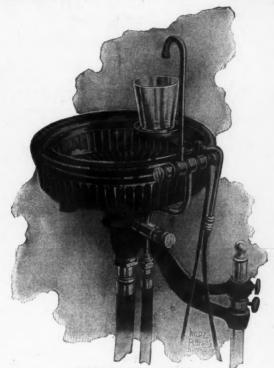
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